Dangerous Structures.*

In the consideration of this subject, it will be well, for its more thorough investigation, to divide it into four headings—viz.: natural decay, defective foundations, faulty construction of superstructure, and such buildings as are erected for temporary purposes. The causes affecting the stability of buildings may be taken under chemical agencies, removal of the subsoil water, mining and underground works, unequally yielding foundations, removal of lateral support, structural alterations, over-loading, wind, fire, lightning, etc. Natural decay is that most common, as the continual action of the carbonic anhydride in the atmosphere, and the alternate contraction and expansion by frost and thaw, gradually but surely (though in different degrees according to the nature or quality of the material), cause that continual waste which is going on over the whole surface of the land. Against this action the only remedy is renewal. Defective foundations bring many otherwise noble buildings into the dangerous class, and also the use of timber below ground, removal of the subsoil water in the construction of sewers, removal of props in mining, building upon the site of ancient and long-forgotten excavations, or upon an equally unyielding foundation, such as rock stepped out. In a rock foundation, unless extraordinary precautions are used in the selection of the materials, and in the elimination of all unequal settlement from a greater number of mortar joints in any one portion of the walling than in another on the same level, any great weight in the building would crush the wall between the two unyielding forces, which would not be the case if the foundation was of a partially yielding nature, such as stiff clay or gravel. Nothing leads to more disastrous results than the use of bad bricks and odd stones in the work below ground, for it should be remembered that the lower the portion of the wall the greater is the weight to be carried. In instances of defective foundations the superstructure must be supported by raking, flying, or needle shores, while the underpinning is carefully carried out. Chimneys, from their exposed position and height, compared with the size of the base, are constantly coming under the surveyor's wing; in dealing with this class of structures, including towers and spires, the vibration caused by the wind and ringing of bells must not be taken as a sign of weakness. Mr. Cowper has said he has known a large square chimney to move one-eighth inch at sixteen feet from the ground, and some chimneys would rock as much as four inches and yet be safe. Many successful attempts have been made to straighten chimneys the foundations of which had partly given way, and by the removal near the bottom of wedge-shaped portions from the side where no settlement had taken place, and by allowing the gravity of the mass in a lever-like fashion to pull over the opposite half to the perpendicular. At Bingly, near Bradford, a chimney over one hundred and fifty feet high was brought back four feet six inches to its original state by the above mentioned means.†

Faulty construction is frequently met with, being the offspring of the excessive desire of society to obtain that which is impossible at the price, and thus foster the jerry-builder and the money-lender. In buildings of this kind walls are often composed of badly-burnt bricks containing much organic matter, and held together by little more than their own gravity, the mortar generally used as the adhesive material being poor in quality and scarce in substance; the timber used in the construction is often of a flimsy kind and insecurely fixed. Such buildings as these are continually coming under the official examination of the surveyor, through the action of most of the causes already mentioned, but more particularly through the removal of lateral support and fire. Buildings of greater importance than those above alluded to may be considered to come under this heading, more particularly erections with ashlar casing and rubble backing. The fall of the tower and spire of Chichester Cathedral, in February, 1871, and that of the chimney-shaft, two hundred and forty feet high, at the Newland Mills, Bradford, on December 28, 1882, may be cited as examples of disasters of this kind, while the judicious restoration of the Cathedrals of Hereford, Salisbury and Peterborough, and the parish churches of Grosmont in Monmouthshire, St. Mary, Stafford, and many others, demonstrate to us the value of timely repairs in protecting these ancient monuments from impending ruin. Many of these works owe their security to the judicious use of iron bands and flying-buttresses.

In all this class of work not more than from four to five feet of wall should be removed at one time. Good, clean cement-concrete should be used if possible, carefully and quietly deposited in the trench and well rammed. The new and old work should be well pinned with slates and grouted with liquid cement. Cement possesses the invaluable property of expanding as it sets, consequently causing the new work to press against the underside of the old. The best ground lime concrete, mixed in the proportion of one to six, will expand as much as three-eighths of an inch to every foot in height, and will permanently retain the size. In the underpinning of a large storehouse at Chatham Dockyard, in 1834, the upper portion of the concrete was forced into the vacant space and up to the bottom of the wall by the use of a framework fitted with screws.

Shores should be near the top of the wall to obtain as much leverage as possible. Fir is the best wood for shores, on account of the grain being generally straight, and it is usually kept in stock in long lengths. The length of flying-shores is limited to about thirty-three feet, as fir above that length cannot easily be obtained. The timber should be sound, and as square in section as possible, truly fitted at the joints, and the shore well made, as there is always some defection in the timber and the possibility of unforseen defects. The action of the wind or the removal of some support may cause an excessive cross strain, which, unless especially provided for, may cause a serious derangement of the work. A special foundation should always be provided for shoring, and the angle at which the sole-piece is placed carefully adjusted, sufficient room being left for the work of rebuilding to be carried on. Care should be taken, in arranging the position of the shores, to well support the chimney-breasts, piers, corbels, and any portion of a structure having extra weight. Temporary structures require especial care in the construction, particularly those used for the reception of large numbers of people, such as stands, hustings, shows, etc. The general tendency is to make this class of structures of the flimsiest kind, on account of the short time they are used, whereas nothing is more trying to the stability of an erection than a moving load of excited people, beating time with their feet or crushing forward.

The consideration of the opposing forces necessitates great care, in order that in all cases a sufficient resisting power may be obtained to counteract any pressure likely to be brought into play. The destructive effects of lightning have of late years been much reduced by the use of copper conductors; nevertheless, instances have occurred within the last twelve months in the spires of Grantham and Sleaford churches. In the case of Grantham the actual damage done by the electric current was small; the spire being fitted with a small copper cord, but with a bad termination. It was decided to fix a solid tape conductor, and ladders were fixed for that purpose. Upon close examination, however, the top sixteen feet (two hundred and eighty-four feet from the ground) was found to be in a very dangerous state, not only by the shock it had obtained, but by reason of the decay of the mortar. Through the dilatoriness of the authorities it fell to the unfortunate lot of the author of this paper to serve a notice to remove the dangerous portion, which was attended to forthwith. At Sleaford the damage done was of a serious nature, a portion of the spire falling during Divine service; happily, no one was injured: the tower was damaged to such an extent that rebuilding of the tower and spire became necessary. Had a conductor been fixed, and the suggestions made in the report by Mr. Kirk, the architect, in 1852, been carried out, doubtless the tower would at the present moment have been standing in its original condition. The action of fire upon walls is usually of a very serious nature, causing many a fine stone building to come tumbling about the firemen's ears, and those having charge of the fire-brigades well know the effect of fire upon the igneous and limestone rocks, and the danger incurred by throwing water upon red-hot substances. The fumes from furnaces in which only coke is burnt have a great disintegrating effect upon brickwork, the author having in his possession a brick, taken from the top of a chimney, eaten away two and one-half inches out of the four and one-half inches in thickness.

*By Sydney G. Gamble, Assoc. M. Inst. C. E., Borough Surveyor, Grantham. A paper read before the Municipal and Sanitary Engineers and Surveyors' Association, and published in the *Building News*.

South America.

Venezuela has just signed a contract with an English firm to build costly and extensive breakwaters at Laguayra, on the coast of Venezuela, a few miles from Caracas. Work will be begun at once on the foundations. The entire breakwater will cost $40,000,000. Blocks of concrete weighing "500 tons each," will be laid in the sea. No money will be taken from the public treasury. The London company agrees to accept a certain sum per package for all merchandise going over the breakwater for ninety-nine years. The Venezuelan government has also contracted to have three new railroads built from the capital city into the interior. A new wharf and court-house are to be built at Puerto Cabello, and the harbor is to be dredged. The expense for the work is likewise to be paid on the package tax system. Montevideo, the capital of Uruguay, contains about 11,000 inhabitants, is pleasantly and conveniently situated as a port, and may be considered the key to the river Platte. It is, perhaps, the cleanest and healthiest city south of the equator. The streets are regular, mostly paved and wide, have an excellent system of tramways crossing the city in all directions, drawn chiefly by horses, which are abundant, hardy and cheap, carrying 9,000,000 passengers yearly. The port conveniences for landing and shipping goods and passengers are very good, and a large port scheme was recently sanctioned which will, when carried out at a cost of $15,000,000, provide a safe harbor for 1,500 or more vessels at one time. There are two or three docks. The principal one for large vessels, on the other side of the bay, was constructed by two rich merchants, Messrs. Jackson and Cibils, at a cost of nearly $2,000,000. Montevideo has many fine buildings, public and private, magnificent gardens and suburban palaces fit for kings, and fine churches. The inhabitants are, as a rule, highly cultivated, kind and hospitable, particularly so to strangers. Great formality and good faith are observed in all commercial transactions, and all business is done on a safe basis.

Three lines of railroad start from Montevideo, six of telegraph, and there are two lines of telephone. Another line of railroad is being constructed in the interior.—*Galveston News*.

The Suez Canal and its Intended Improvements.

Translated for ENGINEERING NEWS *from the Transactions of the Austrian Society of Engineers and Architects No. 24, 1885.]*

BY GEORGE J. SPECHT, C. E.

The Suez Canal is not a creation of the present century, but dates back to the day of Sesostris, B. C., 1600, when it then ran along the Nile to Memphis, and from there to the Red Sea. That ancient canal seems to have been abandoned, and Nero, who intended to build a canal, B. C., 549, was prevented from so doing by the prediction of his priests. Darius, again, in B. C. 500, proposed the same task, but his mathematicians told him that the waters of the Red Sea would overflow Egypt if the canal was built. In the second century before Christ, a canal was actually commenced by Ptolomæus Philadelphus, but the work was neglected in time, and the Turks finally blockaded it against foreign vessels. The philosopher Leibnitz proposed to Louis XIV, of France, to rebuild the canal, and Napoleon I also considered the same scheme.

Thus affairs stood until the advent of M. de Lesseps, who, in connection with Linaut-Bey and Mongel-Bey, persuaded Mahommed Said Pasha, Viceroy of Egypt, to finally undertake the construction of the canal. Ferdinand de Lesseps had been the French Consul-General in Egypt, from 1831 to 1838, and was intimately acquainted with Mahommed Said, Linaut and Mongel. In 1854, the Viceroy invited de Lesseps to re-visit Egypt, and the details of the enterprise were then discussed and agreed upon, and work on the canal inaugurated on Nov. 30, 1854. The agreement stipulated:

That M. de Lesseps shall organize under his direction a company called *Companie universelle du Canal Maritime de Suez*, for the purpose of constructing and operating a large navigable canal. The concession is granted to de Lesseps for a period of ninety-nine years, from the date of opening of the canal for traffic. The work shall be done at the expense of the company; the necessary land, not belonging to private individuals, is given to de Lesseps, free of charge. The Egyptian Government shall receive 15 per cent., the company 75, and the organizers 10 per cent. of the proceeds. The canal shall be open to ships of all nations.

Exact surveys were made, showing the fallacy of the assumption, that the level of the Red Sea was higher (by 32.4 feet,) than the waters of the Meditterranean. Linaut and Mongel proposed a line runing directly from Pelusio to Suez, and Messrs. Talabot and Barrault suggested a line connecting Alexandria, Cairo and Suez. The International Commission to which these two propositions were submitted, decided in favor of the direct line. To prevent the accumulation of sand at the western mouth of the canal, Palescapa recommended the construction of two jetties, built of rip-rap, and 7,500 and 11,000 feet long respectively. The line proposed by Talabot and Barrault was 149 miles longer than the direct line, and required expensive work to cross the Nile, with an open aqueduct as proposed by Talabot, 1¼ miles long, and with the water surface 85 feet or more above low water in the Nile, and 118 feet above sea-level; ten locks would have been necessary, and 105,000 cubic feet of water would have had to be raised per day. Barrault suggested the crossing of the Nile at its own level, with only six locks in the canal.

The commission submitted its report to the Viceroy on January 1, 1856. They said: "The direct canal from Suez to the Gulf of Pelusio offers the only good connection between the Red Sea and the Mediterranean. No great difficulties will be met with in its construction. Its success is certain, and it will be of immense benefit to the commerce of the world. The cost of the construction of the canal will not exceed $40,000,000."

At this stage of the proceeding, England pretended that the canal would be of no advantage to her, and she commenced to oppose the enterprise by all possible means France considered the matter as a simple question of commerce, and de Lesseps started a subscription to raise the required capital. The $40,000,000 was divided into 400,000 shares, and the various nations subscribed as follows: France ranking 1; Turkey and Egypt, 2; Austria, 3; Russia, 4; England, 5; United States, 6; Spain, 7; Netherlands, 8, etc., up to Sweden, which occupied a sixteenth rank. The company was organized on December 15, 1858, by electing boards of general, legal and constructive management.

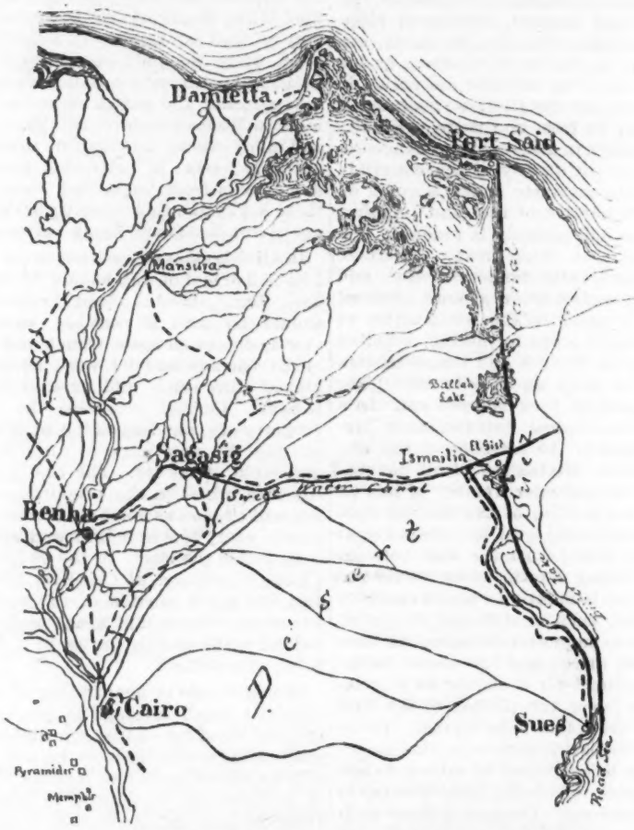


FIG. 1.—ROUTE OF SUEZ CANAL AND ITS SURROUNDINGS.

The geological features of the isthmus are as follows, (from *Etude geologique de l'isthme de Suez*, by M. Tinot); —Commencing at the Mediterranean Sea, the first 24 miles are of recent formation; a narrow sand-spit, separating the Mensaleh lake from the sea, consists of sand, loam, clay and shells. The next 13 miles (Ballah lake division) is another sand bank geologically older than the first and separates the Mensaleh and Ballah lakes; sedimentary deposits from the Nile occur along the edge of lake Ballah. A bank of gypsum is found in the last 3 miles of this division, which is intermixed with layers of clayey and sandy gypsum. The next 5 miles (El Gisr division) are sand, clay, gypsum and hard-pan, with little homogeniety in the ground and it is covered by fine quicksand for nearly its entire length; this is the highest ground traversed by the canal. The following 18 miles (Serapo division) have, at the entrance of the lake Timsah, deposits of quicksand and coarse sand, containing many organic fossils of the period when this part of the isthmus was still fertile. The remainder of this division is sand firmly packed and impervious to water. The next 21 miles (Bitter Lake division) is the most interesting on the Suez Canal. The basin is 9.3 miles long and is 26 feet below mean sea-level; it has dried out by degrees and the bottom (area, 14,000 acres) is covered with a layer of pure sea-salt, 2 to 10 feet thick, and in some places, 8 to 10 feet. Along the edge of this saline deposit is a layer of muddy sand mixed with numerous crystals of salt, and under this is compact clay. The next 9 miles (Chalouf el Terraba division) forms the divide between the Bitter Lake and the Red Sea. It consists of gypsum, heavy clay, sand and sand stone. The last division (Suez) is 10 miles long: at the second mile is a bank of lime stone, and at the 5th mile a layer of hard sand stone. The last part of the isthmus belongs to the more recent geological formation.

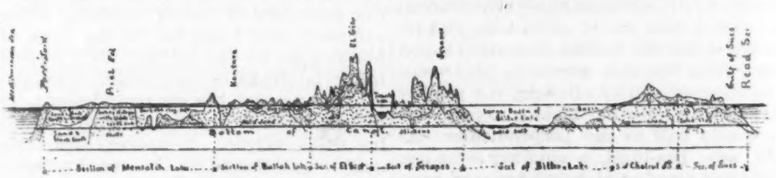


FIG. 2.—PROFILE OF THE SUEZ CANAL.

In order to ascertain the proper width for the canal, a study of existing canals was made by the Commission. Most of the French canals are about 49 feet wide at the water level, 33 feet wide on the bottom, and about 5.4 feet deep. The English canals average 36 to 20 feet wide on top, 24 feet at the bottom and 5 feet deep. The canals in the United States (then 250 miles in aggregate length) have a top width of 40 feet, bottom width of 28 feet

and a depth of 4 feet. The canals in Spain, Germany and Russia have about the same dimensions. All of these canals, however, were built to carry vessels of only 70 to 140 tons, while the Suez Canal was to take ships of 1,000 or more tons. The only similar canal was the Caledonian Canal in Scotland, which was 133 feet wide and 20 feet deep. The Commission proposed a width of 328 ft. and a depth of 21.25 ft. this width permitting vessels to pass. This was not accepted, and it was decided to make the canal from Port Said to the Bitter Lake 190 feet wide at low water, and 26.2 feet deep, and the remainder of the canal 262 feet wide and 26.2 feet deep.

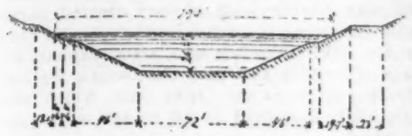


FIG. 3. CROSS-SECTION OF THE SUEZ CANAL.

On May 15, 1860 the commission met again and considered the labor question. Between Ghemile and Quin-Feregh a town had already sprung up, which was called Port Said in honor of the Viceroy. It has at present about 5,000 inhabitants. Another important town is Ismalia and a number of smaller towns grew up along the line of the canal, as El Gisr, Kantara, Ferdane, Toussoum, etc. A department of morals and health was established in each settlement; Ismalia was the central telegraph station and at the same place the superintending department had its head-quarters. The general offices were at Cairo and the head-quarters in Alexandria. A large fleet of sailing vessels transported the material required for construction. From April to December 1863, 295 vessels cast anchor at Port Said. For land transportation, 1,500 camels were used, principally to carry water which was obtained either from the Nile or by distilling sea-water; this water was stored in cisterns along the line.

During the year 1864, 36,000 laborers were employed, of which 1,500 were Europeans, 14,500 natives and 20,000 *Fellahs* furnished by the Egyptian Government, according to the agreement of July, 1859. This last was such a draft on the Egyptian population that the standing army had to be reduced from 30,000 to 10,000 to prevent interruption of farming. One *Fellah* worked 30 days when he was replaced by another one. Later on, the Viceroy declined to furnish any laborers at all, and the Emperor Napoleon, having been appointed arbitrator between the Viceroy and the company, decided that Egypt had to pay the company $7,600,000. On account of the great demand for water, work on the Sweet-water canal from Sagasig to Suez was pushed with energy. This canal follows the old line of Nero mentioned before; it is 41 feet wide on top, 24.4 feet wide on the bottom and 4 feet deep. The 1,308,000 cubic yards of excavation in the Suez end of this canal were moved by 7,000 *Fellahs* in nine months. From Ismalia to Suez, 56 miles, the canal is 49 feet top-width, and 4.9 feet deep; the excavation amounted to 4,380,000 cubic yards, and the canal was finished on December 29, 1863. The benefit from this Sweet-water canal is great, the surrounding country is no longer a desert and $250,000 per annum is saved in water transport.

The work on the Suez canal proper was commenced in 1859; the west mole at Port Said was the first work, this progressed slowly, as the rock had to be hauled from a quarry at Mex, near Alexandria. Since 1863, artificial stone has been used for this mole; 78,500 cubic yards of rock and 327,000 yards of artificial stone were required. After the completion of this mole, excavation was commenced in the lake Mensaleh region; this was done in cuts from 66 to 82 feet wide and was finished by 24 dredges in three years. The capacity of a single dredge varied from 20,000 to 40,000 cubic yards per month, The ground in the section Kus-el-eh was not very firm and the natural slope was from 4 to 6 to 1. The work in the Ballah-lake section was done by hand-labor to the full width of 190 feet and depth of 5 feet; the remainder was done by dredging. The excavation through the ridge of El-Gisr was done largely by hand-labor; 18,000 men moved 5,250,000 cubic yards in 10 months (1862) in this section. When the Egyptian Government refused to furnish new laborers, the work was done by excavators, each of which had an average capacity of 525 cubic yards per day, or, under very favorable conditions, 785 yards; each machine was 18 horse-power. The Serapo section was dug 6.5 feet deep and 190 feet wide by hand, the amount so excavated being 2,600,000 cubic yards. The sections Chalouf-el-Terraba and Suez were partly excavated by the flowing water; a ditch 72.5 feet wide was excavated from the Red Sea to the Bitter Lakes with a grade of 0.035 feet per 1,000 feet, the surface velocity of the stream was calculated at 0.83 feet and the bottom velocity at 0.66 feet per second. The ground in this section can not resist a velocity exceeding 0.48 feet per second. About 12,600,000 cubic yards was washed by this process into the Bitter Lake, and 2,500 acres was thus raised about 4 feet.

The work was carried on with energy, and on August 25, 1865, a vessel, loaded with 300 tons of coal passed from the Red Sea to the Mediterranean, using part way the sweet water canal. At this time England renewed its efforts to prevent the completion of the canal, and, had it not been for the intervention of Napoleon III, she would probably have succeeded.

On November 17, 1869, the canal was opened to commerce. The currents proved stronger than expected; the velocity in the Port Said division to Bitter Lake was 1.64 feet per second, and from Bitter Lake to Suez, even 3.3 feet and more, according to the tide in the Red Sea. At many places the cross-section of the canal was deformed by wash-outs. The shores are frequently damaged by vessels running into them, and also by waves caused by heavy traffic; continuous dredging is necessary to keep the canal open; this is a great annoyance to passing ships. The turn-outs, one at every six miles, are not sufficient to prevent the passing of vessels in the canal proper.

All of these circumstances made an enlargement of the canal, or the construction of a parallel canal, more and more necessary. The International Commission has finally decided to enlarge the entire canal, The committee met in Paris on November 25, 1884, and the general board of directors, in January, 1885, accepted the proposition of the executive committee. The principal points in this proposition are as follows: The depth of the canal shall be increased to a total depth of 29.5 feet below low water level. At present this work shall be confined to securing a depth 27.8 feet, the remaining work shall be done within the following 2 years. (Economy was the purpose in this clause, as the cost of increasing the depth 3.28 feet is not less than $4,800,000). The width of the enlarged canal measured 26.2 feet below low water, shall be: Division Port Said to Bitter Lake, in straight parts, 213 feet, in curves of less than five minutes, at least 246 feet, and in curves of sharper radius at least 262 feet for half the length of the curve. The Division Bitter Lake to Suez, in straight parts, 246 feet; in curves of less than five minutes, 262 feet. The curve in the Timsah Lake shall be straightened by enlargement on the concave shore, to prevent sand deposits. The protection of the slopes in the canal through the lakes Mensaleh and Ballah, and between the Small Bitter Lake and Suez, being absolutely necessary, it was decided to commence protecting works at once. A pavement is to be made wherever the ground permits its use, laid at as steep a slope as possible and extending 7 feet below low water. This pavement is to be laid in trenches excavated before the actual enlargement is done.

The work contemplated is to be done in three periods. First, enlargement of the bottom of the canal to about 121 feet by connecting the turnouts with each other; at the same time the canal shall be deepened 1.64 feet. The estimated cost of this work is $12,248,709, of which sum $439,765 is for protection of the shores. Second period, enlargement of the canal to final dimensions; estimated cost, $25,954,528, of which sum $1,717,125 is for paving the shores. Third period, deepening the canal to 29.5 feet; estimated cost $3,090,166.

The total estimated cost is therefore $41,293,403, which will be reduced to about $40,600,000 by the money realized by the sale of

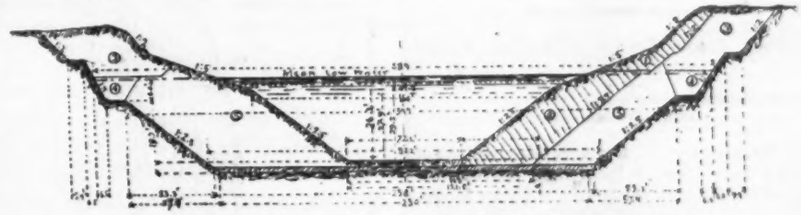


FIG. 4.—CROSS-SECTION BETWEEN BITTER LAKE AND SUEZ.

rights. The total amount of earthwork is estimated at 91,000,000 cubic yards.

The toll to be paid by passing vessels is regulated according to the registered tonnage (1 ton equal to 100 cubic feet of that space in the ship from which an income can be derived); the rate for each registered ton and each passenger is 1.90. This is less than the additional insurance would be if the vessel went around the Cape of Good Hope. The maximum toll is fixed at $2.00. It was stipulated that the toll shall be decreased as soon as the dividend on the shares of the first issue would amount to more than $18, but with a proviso that the dividends could be increased to $25; if the dividend is so large, then the surplus shall be applied to a reduction of toll.

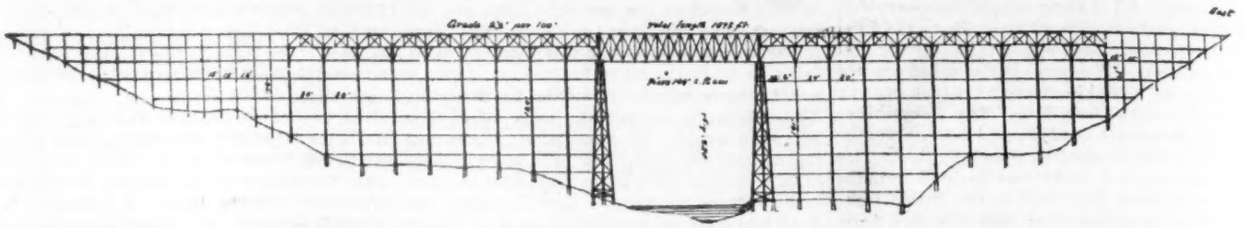
The financial statement of the company for 1883 was:

Total earnings	$13,704,668.75
Total expenses, including 5 % interest and a reserve fund	6,531,960.69
Profits	$7,172,708.26

The mode of navigating vessels through the canal is as follows: The position of the vessels passing through is telegraphed from all turnout stations to the head office; it is marked on a small model. Orders for the proceeding or stopping of each vessel are then given. The vessels are towed into the turnouts; some of these last are formed by a one-sided enlargement of the canal, others by a systematical excavation on both sides. Those built after the first plan have caused collisions of vessels oftener than the latter, because both vessels are steered into the same turnout.

The long time occupied in passing the canal is a serious objection. The maximum speed allowed is 5 knots per hour; this and the time lost in the turn-outs makes the trip a long one. A greater speed, which would be better for steering the vessels is prohibited on ac-

FIG. 1.—MOUNTAIN CREEK BRIDGE; CANADIAN PACIFIC RAILROAD.



count of the dangerous wave-action on the shores. Notwithstanding this precaution, these slopes are damaged continually, although a considerable length of the slopes has been protected by rip-rap.

The area of the cross-section of the canal is 3,956 square feet; this is too small for vessels with a displacement of 645 square feet, and is the reason for running many vessels ashore (from 1870 to 1883, 11 per cent. of all vessels went into the shore.) These stranded vessels are pulled off by three powerful steam tugs, at the expense of the canal company, this work usually consumes 5 hours. The average time of an undisturbed passage, in 1884, was 38½ hours, while the total average since opening the canal is 41 hours 22 minutes; 27 per cent. of this time was consumed in waiting for the passage of other vessels.

Mountain Creek Bridge.—Canadian Pacific Railway.

Written for ENGINEERING NEWS.
BY W. A. DOANE, C. E.

This large structure, a general description of which is here given, is located on the eastern slope of the Selkirk range of the Rocky Mountains. From the summit of the range just mentioned the line of railway descends with a maximum grade of 116 feet per mile for a distance of 17 miles, crossing in its course several deep ravines and narrow valleys, requiring bridges and trestles of more than ordinary size, this one being more than 14 miles from the summit. On account of the great cost and difficulty of teaming now ahead from the end of track, and in view of the fact that no suitable stone could be found within a reasonable distance, it was decided to build the whole structure, foundations included, so far as possible, of wood, timber being very abundant and good, mostly spruce and Douglas fir.

Fig. 1 is a skeleton elevation, showing general style and spans, which are as follows: Sixteen 15-foot spans at the west, and seven at the east end 345 feet; seventeen 30-foot spans, 510 feet, two 33'-6" spans, 67 feet, and one span 149 feet; all center to center, making a total length of 1,071 feet. The 15-foot spans at the west end are on a ten degree curve (grade reduced to 1.9' per 100') all others on tangent. Piles driven from six to twelve feet in firm earth, with occasional boulders, form the supports for trestle bents and piers throughout, the total number required being 596. These were cut off not more than five feet above surface of ground to receive the short caps and the sills, the latter being carried horizontally across as in Fig. 3, although in many places the transverse slope of the ground required from two to 8 feet cutting, which was trenched out before the piles were driven.

Half of Fig. 2 shows trestle bent for the 15-foot spans; ties are 8" × 8", spaced 8" apart in clear, every fourth one projecting four feet to support walk and railing; every alternate span has 2-9" × 15" stringers under each rail; intermediate spans 3-6" × 15" over-lapping joints; in addition, a line of 9" × 15" pieces under each guard rail; the figure shows size and number of posts, etc.; top of piles to base of rail varies from 20 to 79 feet; the sills, caps, posts, etc., for these spans were hewn.

Half of Fig. 2 shows trestle bent for 30 foot spans, an extra price being paid to contractors for timber more than 30 feet in length; the decks were made 14' 6" high, so that posts, (all reach two decks,) would not exceed that; half the joints in center groups of posts are at cross walls, others are in centers of decks; rails are laid on 8" × 12" ties, spaced, etc., as in the 15-foot spans; being supported by two double lines of 9½" × 15" stringers, packed and carried continuously directly over the 30 foot trusses; top of piles to base of rail varies from 69 to 141 feet. Each of the two piers is formed of three bents (Fig. 3,) very similar to those of the 30 foot spans, joined by bracing-wales, etc., as shown; top of piles to base of rail at one pier is 143 feet, the other 140' 6¾"; screw bolts and washers are used throughout to pack posts at both cross and longitudinal wales, at all joints, etc., and ½" × 9" wrought spike for all 4" × 10" braces. The piers carry an ordinary Howe truss span, built somewhat heavier than usual; false work was carried up for this, consisting of six bents with pile foundations, each having 4-8" × 8" posts in 29 foot lengths, with 8" × 10" sills and capsills, each set well braced both ways, and with longitudinals 14' 6" apart vertically.

A portable saw mill was erected as near the site of the bridge as possible, and began running January 26, 1885, averaging 20 M. per day; at the same time contractors began cleaning off the heavy timber and underbrush for camps, offices and framing grounds; the right of way having been already cleared, three pile drivers were started January 26, and February 10th. Framing was begun January 31, and raising on February 16th, with a force of 60 carpenters at the latter date, which was gradually increased to 100 as the work progressed.

Except, for the 149 foot span, the iron was teamed in from end of track, a distance of eight miles, for that, the timber was sawn and framed at another mill twenty-one miles east, being delivered with the iron by train; when the track had reached the bridge, April 20th.

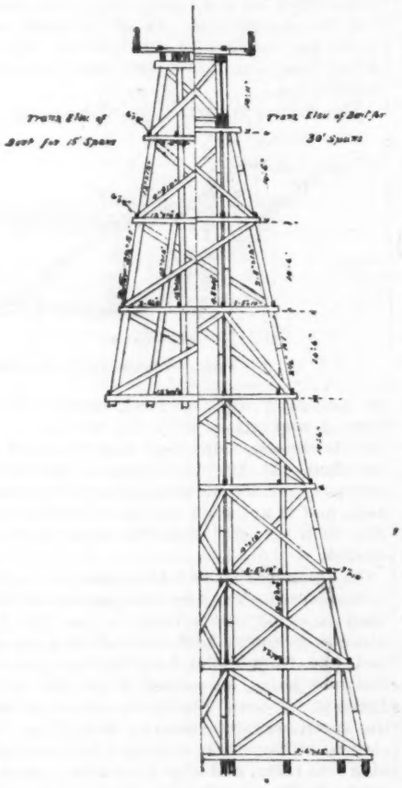


Fig. 2.

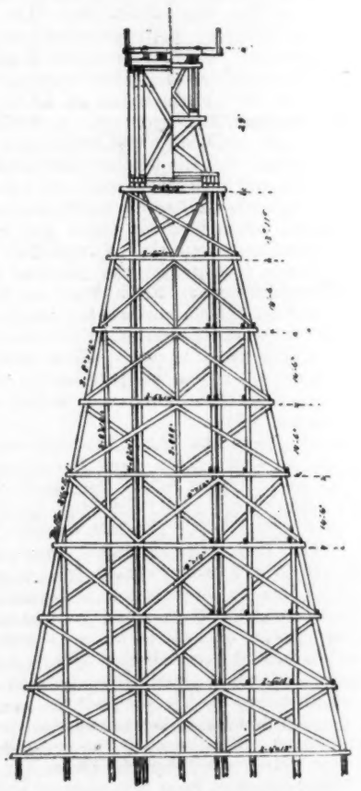


Fig. 3.

April 1st a strike occurred, and work was suspended for a week. April 28th a train crossed the bridge for the first time, and little remained to be done but lay the footway and put up the railing. It will be seen by the general design that a large force of men could be employed and work to good advantage; all framing was done from patterns, and the different pieces put together only when raised to their places, the raising being done by a 10 H. P. engine, and three hoists, the gin poles being lashed to the posts and raised from time to time as required.

The bridge is designed to safely carry a Baldwin consolidation locomotive, having 116-000 pounds on 21-foot wheel base, followed by maximum weight of tender and train with a wind pressure of 300 pounds per lineal foot for

train, and thirty pounds per square foot on twice the projected area of side.

While the arrangement of posts etc., in the style of bent adopted is far from being above criticism, yet the pressure is well distributed over the foundations, and framing and raising were simply and quickly done.

The cost was somewhat increased by adverse circumstances, the snow being fully five feet in depth, which had to be removed by shoveling; high prices of labor and material, etc. Wm. McKenzie & Co., were the contractors; R. Balfour in charge of framing and erecting, and it is but just to add that no accidents occurred.

James Ross, C. E., is Manager of Construction and Chief Engineer of the Mountain

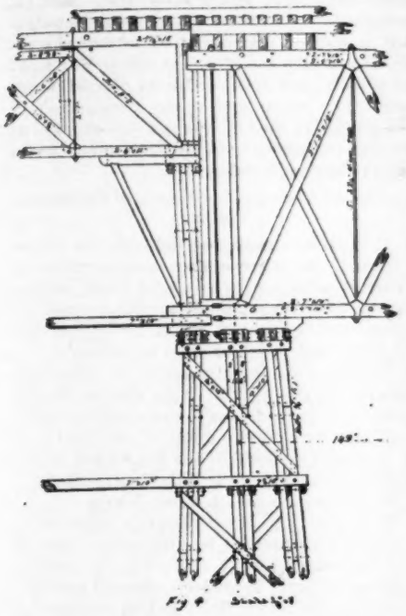


Fig. 4.

Division C. P. R. The writer has charge of the designing and draughting office. Below is given the cost to the company of the finished structure.

Clearing right of way extra width for fire protection	$1.525.00
Clearing snow	1.472.00
Excavation for foundations, riprap, etc	6,754.00
Piling	4,200.00
1-149 foot span, 88,066 B. M. at $55.00 per. M. (Contract.)	4,843.63
1-930 foot spans, 146,997 B. M. at $40.00 per M. (Contract)	5.879.88
Trestle bents, piers, etc 854.889 B. M. at $40.00 per M. (Contract.)	34.195.56
False work 149' span 50,000 B. M. at $16.00 per M. (Contract)	8.00.00
1-149' span 29,342 lbs. cast iron at 4 cts., including freight	1.173.68
1-149' span 38,264 lbs. wrt. iron at 4½ cts., including freight	1,721.88
1-930' spans 22,629 lbs. wrt. iron at 4½ cts. including freight	1.018.30
1-930' spans 3,192 lbs. wrt. iron at 4 cts. including freight	127.68
Trestle bents, piers etc., including extra spike for staging, etc., 50.111 lbs. wrt. iron at 5½ cts. including freight	2,756.10
Trestle bents 19,137 lbs. cast iron at 3 cts. including freight	574.11
Iron teamed 8 miles, 47½ tons at $6.00	285.00
Total	$67,326.82

It cost the contractors 750 dollars to clear off the snow and timber for two framing grounds, one 150′ × 300′ and one 200′ × 400′, and for clearing away and erecting buildings for the men, for offices, etc. $2,000.

BRITISH ship building is almost collapsed for the present. The half year's tonnage foots up 200,000 tons, against 440,000 tons for the first half of 1884, and 628,000 tons for the first half of 1883; but these figures are no more discouraging than our railway construction statistics

Suggestions for a Schedule of Sanitary Ordinances for the Town of ——,

PREPARED BY WM. PAUL GERHARD, C. E., CONSULTING ENGINEER FOR SANITARY WORKS, NEW YORK CITY.

A—Rules as to Healthful Building Construction.

1. It shall be considered unlawful hereafter to erect or cause to be erected a new building upon any site which has been filled up with house refuse or any kind of animal or vegetable matter, unless such matter shall have been properly removed from such site.

2. It shall be considered unlawful hereafter to erect or cause to be erected any new buildings or structures of any kind upon any damp or wet site unless such site shall have been effectually drained by means of suitable properly laid earthen ware tile pipes.

3. It shall be considered unlawful to lay such drain pipes in such a manner as to communicate directly with any drain carrying foul sewage, a sewer or cesspool.

4. The drainage of the subsoil of buildings shall conform to the following regulations and requirements:

a. The subsoil drains shall be laid, if possible, at a depth of not less than two feet below the cellar floor.

b. Tney shall be laid with open joints, protected against entrance of dirt or vermin by paper or muslin wrapping or collars.

c. They shall be laid on a true grade, with perfect alignment and with a continuous fall towards the outfall.

d. The outfall shall be either directly into the open air, or into a ditch or road gutter.

NOTE.—If connection must, necessarily, be made with a sewer, arrangements shall be made for perfect disconnection, and the water seal of the trap must be maintained, even in the driest seasons, by suitable arrangements, approved by the inspector.

5. Wherever the building site is damp, the cellar floor shall be constructed with at least six inches of concrete. It is recommended to put on top of this a thin coating of coal tar pitch or asphalt.

It is recommended that every wall of new buildings be provided with a damp-proof course of proper material, placed above the level of the ground, and also that the outside and inside of the foundation wall to the height of the damp-proof course be coated with coal tar pitch or asphaltum.

It is recommended to whitewash the cellar walls at least twice a year.

6. The air supplied to a heating apparatus in the basement or cellar shall not be taken from the cellar, but always from the outside atmosphere and, preferably, from a point about ten feet above the ground.

7. Buildings without basement or cellar shall be placed on brick or stone piers, or posts, and the floor of the first story raised so as to be at least two feet above the surface of the ground. There shall be a free circulation of air underneath the floor, and between it and the surface of the ground.

B.—Rules as Connection Between House Drains and Street Sewers.

3. It shall be considered unlawful to connect or cause to be connected, any private drain with a street sewer without first obtaining a permit from the village authorities.

2. It shall be considered unlawful hereafter to construct any drain for any building and to connect the same to a street sewer, unless the drain shall in its plan and construction conform to the following requirements:

a. Each building shall have a separate connection with the street sewer.

b. Wherever junction pieces have been built into the sewer they must be used for making said connection, unless special permission is obtained to cut the sewer.

c. No pipe or other materials for drains shall be used until they have been examined and approved by the authorities, or their duly appointed superintendent or inspector. No house drain to be larger than four inches inside diameter, except by special permission.

d. No street shall be opened until the junction piece in the sewer has been located by the superintendent.

e. If no junction pieces are built into the sewer, a connection shall be made by inserting into the sewer a junction pipe of proper size, and cut slant to an angle of forty-five degrees by the manufacturer. Great care must be taken not to injure the sewer, and all rubbish shall be carefully removed from its inside.

f. In connecting a house-drain with a pipe sewer, a Y junction must be used, and the main sewer left in a good condition.

g. In all cases the trench must be opened to the point of connection without tunneling, so as to allow of an easy inspection.

h. In opening any street or public way all materials shall be placed where they will cause the least inconvenience to the public, and the whole inclosed with sufficient barriers, and properly lighted at night from the beginning to the end of the work.

i. The least inclination of the house-drain shall be 1 in 60, unless a written permit is obtained to lay the house-drain to a lesser grade.

k. When the course of the house-drain is not the same as the junction piece, it must be connected therewith by a curve of not less than ten feet radius. All changes of direction to be made with curved pipe, and in no case must a pipe be clipped.

l. Every joint shall be laid with gasket and cement, and bedded in hydraulic concrete at least four inches in depth.

m. The ends of all pipes not to be immediately connected shall be securely closed, water-tight, and guarded against entrance of earth with imperishable materials. The inside of every drain, after it is laid, must be left smooth and perfectly clean throughout its entire length, and true in line and grade.

n. The back-filling over drains, after they are laid, shall be puddled or rammed, all water and gas pipes protected from injury or settling, and the surface of the street made good within forty-eight hours after the completion of that part of the drain lying within the public way.

o. No privy-vault or cesspool shall be connected with the house-drain or sewer.

C. Plumbing Regulations.

1. No plumbing work of any kind shall hereafter be constructed in any building, nor connection made between a house-drain and a street sewer, unless said work shall be made to conform strictly to the following requirements:

a. The house-drain may be of glazed vitrified pipe to within five feet of the outer line of the house foundation walls. From this point to the inside it shall be of cast-iron pipe, at least ½ inch thick, and with joints well caulked with lead, and made air and water tight.

b. All lines of soil or waste pipes in a building shall be of metal.

c. The house-drain shall be trapped, near the point where it leaves the building, by a running or half S-trap, which shall not be larger in diameter than the house drain. This trap shall be placed in an accessible position, and should be provided with an inspection hole, and a tight closing cover.†

† This refers to connections with old and improperly constructed, and often foul, street sewers, and to cases where house-drains discharge into a cesspool or flush-tank. For well-constructed, self-cleansing sewers, provided with flushing arrangements and ample ventilation, the trap should be omitted. In the latter instance it should be made a law that in every house connected with the street sewer there shall be an uninterrupted flow of air passing from the sewer up the house-drain and soil pipe, and out at the roof, or *vice versa*.

The house-drain shall not be laid beneath the cellar floor unless absolutely necessary, and in this case it shall be laid in a trench and shall be surrounded with concrete. The trench shall be closed after the drain is thoroughly inspected and pronounced perfectly tight.

All connections in horizontal pipes to be made with Y branches.

d. There shall be a fresh air inlet pipe, entering the house-drain just inside of the main trap, of a diameter of not less than three inches, and opening at any convenient place out of doors, approved by the superintendent or inspector.‡

e. All soil and waste pipes shall be run in as straight a manner as possible up to, and at least three feet above, the main house roof. The upper terminus shall not be located too near a window, ventilating shaft, or chimney flue; the outlet above the roof shall not be capped by either a return-bend, ventilating cap, or movable ventilator.

Extensions of soil or water pipes shall not be constructed of sheet-metal or earthenware, and no soil, waste or vent pipe, shall stop in any brick or earthern chimney flue, serving as a ventilator.

f. No soil pipe shall be larger than four inches, and no waste pipe larger than two inches inside diameter.

g. Before the fixtures are placed in connection with the pipe system, and before the soil pipe and iron house drain are connected with the outside drain, the outlet of the house drain and of all its branches shall be closed tight and the pipe filled with water to its top, and every joint shall be carefully examined for leakage, and all leaks shall be securely closed before connections are made with said pipe-system,

h. All soil and waste pipes shall be kept outside of walls or partitions, and the system arranged in such a manner that it may at all times be readily examined and repaired.

i. Every fixture in the house shall be separately and effectually trapped, by a seal-retaining trap placed close to the fixtures, and arranged so as to be safe against back-pressure, self-siphonage, loss of seal by evaporation or siphonage.

k. No branch waste pipe for tubs, sinks, basins, to be larger than one and one-half inches diameter.

Connections of lead pipes with iron hub pipes, shall in all cases be made with brass ferrules, properly soldered to the lead, and well caulked to the iron pipe.

l. Every water-closet shall be adequately flushed with water from a special flushing cistern, arranged directly above it, except that where a cistern is liable to freeze, other methods may be permitted, provided that thorough and sufficient flushing is secured. Every water-closet apartment shall have direct means of ventilation into the open air. Pan closets shall not be used in any building. The outlet of water-closets shall not be larger than three inches in diameter.

m. No opening shall be provided in the house drain for the purpose of receiving the surface drainage of the cellar, unless special permision is previously obtained.

n. All rain-water conductors which are carried up within the walls of a building shall be of iron pipe. Connections with such rain-water pipes along their vertical course for the discharge of sewerage or waste water therein will not be permitted. Rain-water conductors shall be trapped if they open at the top, near windows, ventilating-shafts, or flues.

o. It shall be unlawful to throw or deposit, or cause or permit to be thrown or deposited, in any vessel or receptacle connected with a public sewer, any garbage, hair, ashes, fruit or vegetables, peelings, or kitchen refuse of any kind, rags, cotton, cinders, or any other matter or thing whatsoever, except faeces, urine, the necessary closet paper, and liquid house slops.

p. Waste pipes from refrigerators or other receptacles, in which provisions are stored, shall not be directly connected with a drain, soil pipe, or other waste pipes, but shall be made to discharge over an open tray, provided with a waste pipe and seal-retaining trap.

q. No steam exhaust shall be directly connected with any soil or waste pipe, or drain communicating with a street sewer.

r. Drip pipes from safes, under any kind of plumbing fixtures, must not have any connection with any soil, waste ar drain pipe.

s. Overflow pipes from water tanks shall not be connected to any soil, waste or drain pipe.

D. Regulations Referring to Privy-Vaults, Cesspools, and Earth-Closets.

1. Leaching cesspools shall be prohibited everywhere.

2. Privy-vaults and cesspools shall not be permitted for any building in reach of and accessible to a street sewer.

3. It shall be considered unlawful to connect any vault or cesspool of a building with a private sewer.

4. No privy vault or cesspool shall hereafter be built, except in accordance with the subjoined regulations, and pursuant to a permit first obtained from the village authorities; nor shall any shed or cover be made or put upon or over the same, until it has been inspected by the proper inspector, and found to correspond to the regulations.

a. No privy-vault or cesspool shall be placed nearer than ten feet from a building, unless special permission is first obtained to do so.

b. Every privy-vault or cesspool located within a distance of twenty-five feet from any building shall be suitably ventilated by means of two four-inch pipes, the one kept at a height of about seven feet from the ground, and the other carried to the nearest wall of the building, and to such a height, that its upper terminus will be at least ten feet above any window. This pipe to be constructed of the same material, and with as air-tight joints as called for under "Plumbing Regulations" for soil-pipes.

c. Every vault or cesspool to be constructed of suitable bricks, approved by the inspector, and with joints laid in best hydraulic cement mortar.

The walls to be not less than eight inches thick and to be made perfectly water-tight and rendered, inside and outside, with a neat coat of pure Portland cement, or else to be cemented on the inside and to have on the outside a backing of at least 9 inches of well-puddled clay around and beneath such brick work.

d. Each cesspool to be well and securely covered or arched over, and to be fitted with a well closing iron man-hole cover for inspection, and to be rendered accessible for the purpose of removing its contents and cleansing the cesspool.

e. No surface water or rainwater from leaders shall be discharged into any vault or cesspool.

f. No cesspool or vault to have any connection by a drain pipe or otherwise with a street sewer.

g. Vaults and cesspools shall be cleaned out as often as necessary to prevent them from getting full and overflowing on to the surface of the ground.

h. No person shall empty or cause to be emptied any vault or cesspool unless a permit is first obtained to do so. The emptying shall be done in a manner so as not to cause any offense.

i. No contents of any vault or cesspool shall be transported through any street unless it be removed by means of an air-tight apparatus which shall prevent entirely the escape of any noxious or offensive odors.

5. Every person who shall construct an earth-closet in connection with a building shall furnish such earth closet with a receptacle of suitable construction and of adequate capacity, for dry earth or other deodorizing substance and said receptacle shall be constructed in such a manner and so placed as to admit of ready access to said receptacle for cleaning purposes. Suitable means or apparatus shall be provided in connection with said receptacle for the effectual application of a sufficient quantity of dry earth or other deodorizing substance,

Said receptacle shall be constructed of a capacity not exceeding ten cubic feet. Said receptacle to be constructed of such materials and in such a manner as to prevent any absorption of filth deposited therein, or any leakage of any part of the contents of said receptacle. Said receptacle to be constructed in such a manner that it may not be exposed at any time to rainfall or to the drainage or waste liquid from the premises.

E.—Rules as to Disposal of Slops and Pollution of Streams.

1. It shall be considered unlawful to throw or cause to be thrown any chamber slops or slopwater or sewage of any kind from habitations, or wastes from manufacturing establishments, into the ground about buildings, nor into any creek, pond, or open watercourse.

2. It shall considered unlawful to allow any soakage into the ground from stables, barns, pigsties, cattle yards, fowlhouses, of slopwater, liquid manure or waste water of any kind.

3. A proper disposal of the slops shall be accomplished by one of the following methods.

(*a*). by connection with a street sewer,

(*b*). Wherever no street-sewer is accessible, the waste water to be run either into a tight cesspool, built according to regulations, properly ventilated, cleaned and disinfected, or into a flushtank in connection with a system of surface or sub-surface irrigation where ample grounds are available about a building for such purpose .

F.—Rules as to Removal of Garbage and Ashes, Snow, etc.

1. It shall be considered unlawful to throw or allow to be thrown, any garbage or solid manure, swill or offal of any kind on to the ground about buildings.

2. It shall be considered unlawful to allow the accumulation of garbage or offal or any manner of refuse in or near habitations.

3. Whatever garbage or refuse cannot be burned up in the range, and all that is not fed to fowls, pigs or other animals on the place shall be kept in water-tight, well covered receptacles that can be easily lifted, handled and emptied by one man, and these vessels shall be kept readily accessible to the garbage collector, and the offal shall be frequently collected and removed by water-tight carts, wagons or other vehicles securely covered, but must not be kept exposed to view.

Ashes shall not be mixed with garbage, but must be kept in separate well constructed iron vessels.

4. It shall be considered unlawful to deposit or cause to be deposited any solid house refuse garbage, or any kind of vegetable or animal matter on any empty building lot to fill the same up to grade. Screened ashes, entirely free from organic impurities, may, however, be used for such purpose.

5. It shall be considered unlawful to throw or place any coal or wood ashes into or upon any paved street or sidewalk except in suitable boxes or vessels on the sidewalk near the curb-stone.

6. It shall be considered unlawful to suffer or permit snow to remain more than six hours after the same has ceased to fall upon any paved footway or gutter in front of any build-

‡ When the trap is not required the fresh air inlet should be omitted.

ing, or vacant lot, and the occupier, or, if unoccupied, the owner of the lot shall be held liable.

7. It shall be considered unlawful to cast or throw down out of any cart, wagon, or other vehicle, rubbish, offal, filth, dirt, earth, animal or vegetable refuse of any kind, swill, the carcass of any dead animal, or any manure, urine, excrement or filth from vaults, cesspool or privies, in any highway or into any vacant lot.

8. It shall be considered unlawful to place, deposit or throw or cause to be thrown, any broken glass, china, crockery-ware, cuttings of tin, sheet-iron, nails, hoopskirts, or any other articles calculated to wound or bruise man or animal, on any public street or highway.

9. It shall be considered unlawful to cast or throw, or cause to be thrown, on the sidewalks of public highways any fruit or the peeling thereof.

10. It shall be considered unlawful to throw or cause to be thrown, on the sidewalks of public highways any straw, hay, hoops, staves, shavings, sweepings, or rubbish of any kind from stores, manufactories, shops or dwellings.

G.—Rules as to Slaughter Houses, Rendering Factories and Offensive Trades.

1. It shall be unlawful to keep a slaughter-house or a cattle-yard without a permit, obtained from the village authorities.

2. It shall be the duty of every butcher and of every person owning, leasing or occupying any place, room or building where any cattle are killed, to cause such places and their yards to be thoroughly cleansed and purified, and all offal, blood, fat, garbage, refuse and unwholesome or offensive matter to be therefrom removed, at least once in every twenty-four hours. No blood or dirty water or other substance from slaughtering cattle shall be allowed to run into any street, avenue, sidewalk, alley or place.

3. Every building used as a slaughter-house must conform to the following regulations:

(*a*). It must be thoroughly and adequately ventilated.

(*b*). It must be properly drained and sewered, by a properly made connection with a street sewer, or else by running wastes into a large water-tight sewage tank.

(*c*). The floor of such building, and the yard shall be cemented and rendered non-absorbent.

(*d*). Properly trapped gullies must be provided in the floor and yard to carry away all liquids, blood, foul wastes, etc.

4. It shall be considered unlawful to carry on any offensive trade, such as those growing out of slaughtering as fat-melting, hide-curing, gut-cleaning, bone-boiling, glue-making, etc., or similar ones, without obtaining first a written permit from the village authorities.

H.—Rules for Docks and Vessels.

Docks.—1. It shall be considered unlawful to take any ship, boat or other vessel to any dock, pier, wharf, bulkhead or slip, for the purpose of the shipment or removal of any offal, garbage, rubbish, blood, or offensive animal or vegetable matter, dirt or dead animals, without a permit from the village authorities.

2. It shall be considered unlawful to throw or deposit, or cause to be thrown or deposited upon any dock, pier, wharf or bulkhead any liquid or solid refuse, or animal or vegetable refuse matter of any kind, and it shall also be considered unlawful to throw or deposit, or cause to be thrown or deposited from any dock or pier with the water any liquid or solid refuse of any kind, or any garbage, or ashes or straw, bedding, clothing or other substances without a special permit from the village authorities.

Vessels.—3. It shall be considered unlawful to bring to any dock, pier, wharf or slip, and to unload or keep on storage at said pier, wharf or slip, any skins, hides, rags, or cotton, having been brought from any infected place, without having first received the written permit of the authorities so to do.

4. It shall be considered unlawful to remove or aid in removing from any vessel to the shore any person suffering from, or having been exposed to, and hence liable to develop any contagious disease, nor to remove or aid in removing any articles that have been exposed to the contagion of any such disease except in accordance with a permit from the authorities.

5. It shall be considered unlawful to take to any vessel any cargo or passengers before said vessel shall have been thoroughly cleaned and dried, and also thoroughly disinfected if coming from an infected port.

Aberdeen Granite.

An article in the *Scotsman* describes the progress which is seen in the granite industry of Aberdeen:

The principal quarries now in active operation are those of Rubislaw, Sclattie, Dyce, Dancingcairns, Persley, Cairnery, Tyrebagger, Kintore, Tamsforest, Paradise, (the latter two being near Kemnay), Corrennie, Tillyfourie, Alford, Peterhead, Angustown, Banchory, and Cambus o' May, where there are three. In the immediate vicinity of Aberdeen, the number of quarries, in which the granite is of various shades of color, is thirteen, and in these over 1,000 men are steadily employed. The total number of quarries in the county exceeds thirty. Some conception of the immense quantity of granite quarried may be gathered from the fact that one employer alone disposes of as much as from 40,000 to 50,000 tons a year. With respect to the matter of wages, we find that at one large quarry the men are paid from 15*s.* to 30*s.* per week, and the total outlay of the employer for wages amounts in a fortnight to over 1,400*l.* Just now at Kemnay as many as 300 men are employed. There are at Peterhead eleven red quarries, employing about 250 men. The principal employers of labor there are Messrs. Alex. Macdonald & Co., Aberdeen; J. Wright & Son, Aberdeen; J. Frazer & Son, Aberdeen; the Aberdeen Granite Quarrying Company; Messrs. Heslop, Wilson & Co.; Mr. James Hunter, Aberdeen; the North of Scotland Granite Polishing Company, etc. It is probable that the output from the Peterhead quarries has not increased in the same ratio as that from the other quarries in Aberdeenshire. Some ten years ago, however, an enormous quantity of granite was sent to America from these red quarries; but the money collapse put a considerable check upon the demand. A change of taste has also manifested itself. At one time red Peterhead granite was nearly the only variety polished; it is now being more extensively used for ornamental purposes although a good deal is still utilized in monumental work. The supply is practically inexhaustible.

It would be superfluous to mention the innumerable purposes to which granite is now applied. The fabrication of masses of rugged rock into artistic decorative works has been a distinct business in Aberdeen for about half a century; and from comparatively small beginnings, has now become one of the most important branches of industry in the North of Scotland. As is pretty well known, the first experiments in the art of granite-polishing, were those made by a citizen of Aberdeen—Mr. Alexander Macdonald—about the year 1818. Previous to this period all dressed granite work was done by small picks; and it was only when the County Buildings in Union street were being erected in the following year that chisels and puncheons were first tried. By means of the improved appliances, the well-known grayish-white granite o Rubislaw, the rich red hued product of the Peterhead quarries, the delicate pink shades, the slate-colored variety, and the finely-shaded blues from other quarries, not only found their way into many of the noblest public buildings in every part of Great Britain, but they furnish enduring memorials of departed genius and worth, in every quarter of the globe. Of late years a large demand has sprung up for granite work, in the shape of exterior columns and pilasters, as well as for all sorts of interior decoration. Taking America alone, we have learned the value of polished granite despatched from Aberdeen to that country, within the past five years. In 1880 the export represented the sum of 12,343*l.* 15*s.* 10*d.*, and in 1881 it amounted to 14,344*l.* 3*s.* 8*d.* The following year—1882—also showed an increase, the figures for the four quarters being respectively 2,641*l.* 8*s.* 8*d.*, 3,374*l.* 10*s.*, 4,196*l.* 5*s.* 3*d.*, and 5,533*l.* 11*s.* 6*d.*, making a total of 15,745*l.* 15*s.* 5*d*, for 1883, the sum rose to 18,807*l.* 7*s.* 11*d.*, and last year the total value had still further increased to 25,930*l.* 17*s.* 1*d.* In 1880, therefore, the average per quarter amounted to 3,085*l.* 10*s.*, while last year it was equal to 6,482*l.* 14*s.* 3*d.*, the total output for the period embraced being 87,172*l.* So far at the early part of the present year is concerned, the value of the exported polished granite to the States has been over 11,700*l.* But for the import duty, which amounts to something like 30 per cent. on the value, it is said that the trade with America would be greatly increased.

The demands on the polishing trade have, as indicated, increased to quite a remarkable extent. It is within the memory of the present generation of Aberdonians, when there was scarcely such a thing as granite polishing at all; and, at the present time, more wages are paid, in connection with the working of granite, than in any other single industry in the country. Engaged in the manufacture of the material alone, there are at present in Aberdeen, twenty-five firms using steam power, and employing 1,100 men; and there are also thirty smaller firms, who do not use steam power, giving employment to about 250 men. The large number of small firms that have started up in recent years has, of course, operated on the prices for monumental and other work. The days of monopoly in this particular branch of industry, have passed away, and competition in this as in every other department of trade is getting keener.

Testing Cement.

Make up two circular cakes of neat cement six inches in diameter, and half an inch thick, with the smallest quantity of water; when they are sufficiently set to permit of their removal from the board on which they are mixed, put one of them into water and the other in the open air. After 24 hours' immersion, examine the water cake carefully, and if there are no indications on its surface of cracks or hair-like fissures, it may be considered free from an excess of lime and thoroughly hydraulic in character. The cake in the open air should be light gray in color; but if it proves to be yellow and ochrey, the cement contains too large a proportion of clay, and is deficient in tensile strength. Such a quality is not absolutely dangerous, although falling short in the more valuable properties of a good Portland cement. Portland cement of this quality may be used, but if the water-cake cracks, and the air-cake is of a whitish-grey color, the cement should be at once removed from the works.—*Henry Reid.*

Tool makers will be interested in knowing that a process has been discovered and perfected by which old rails at a cost of $17 per ton can be turned into good edged tools.

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IN the article on Electrical Units, published last week, the first formula contains an error of form that might probably puzzle the reader, and that is the two dashes under the R and C. These dashes in the copy were simply the printers' sign that capitals were to be used; they should be erased and the formula would read:

$$C = \frac{E}{R}, \text{ or } E = C \times R, \text{ or } R = \frac{E}{C}$$

In the last paragraph of the same article "$C\,M\,F$" should read $E\,M\,F$, which expression signifies electro-motive force.

System and Uniformity in Water Works Reports.

We reprint elsewhere the summary of the annual report, for 1884, of W. H. Richards, Superintendent of the New London Water-Works, Connecticut. This summary is in accordance with the recommendations of the New England Water-Works Association, adopted at its last meeting.

The purpose is plain and the value of a recognized uniform system in making out these annual tables is undeniable. When the manager of a water-works can intelligently compare the results of his personal efforts with those of another corresponding system, he has some useful basis upon which to estimate relative efficiency of management. As too often issued, annual reports are provoking in the obscurity of their statements; they are practically valueless outside of the limited circle acquainted with their controlling details and circumstances.

In the statement published, the supply is by gravity, and though this is implied we think it should be so plainly stated. We trust that the example thus set by Mr. Richards will be followed by his associates, and the system still further extended and improved, until uniformity is introduced into all annual reports and the data then sent out to the water-works world would be of great practical value.

The New Croton Aqueduct.

A visit this week to the upper end of the New Croton Aqueduct, or the 68,000 lineal feet included in the contract with Brown, Howard & Co., shows good progress and most excellent organization and management on the part of the contractors. Properly impressed with the magnitude of the work in hand, these parties have wisely expended both time and money in getting ready, in every sense of the word, for economically and efficiently driving this very pretty length of tunnel.

The plant is without exception one of the most complete we ever saw on contract work, and Mr. D. D. McBean, a member of the contracting firm, deserves especial credit for the very practical and thorough manner in which the work is equipped and the evident discipline pervading his force. The shafts are well timbered, where timbering is required; the head-houses well built; the cages are of the Dixon coal-mining pattern, with safety appliances, counter-weights, etc., and the hoisting plant is from the Dixon Manufacturing Co., of Scranton, Pa. The air-compressing and rock-drilling plant are of the latest designs of the Ingersoll Rock Drill Co., of New York. The cars, among other new ideas, are worthy of particular notice; Mr. McBean has here devised a dumping-car that is new to us and well meets the demands for efficiency in this important agent in tunnel work. To briefly describe it, there is first a stout, square frame to which are attached the journal-boxes and wheels; on top of this frame, on each side, is a series of rollers, about 2 inches in diameter and 3 inches long, and upon these runs the body of the car proper which has a capacity of 43 cubic feet; a small channel plate on the bottom of each side of the box serves as a track for the rollers, On each side of the car-body is a hook which engages in an eye fixed in the end of the wheel-frame when the car-body is pushed forward on the rollers at the dump, and thus permits the car to revolve on these axes and discharge its contents: there is an end-door hinged at top in the usual manner. The advantages of this car are, large capacity, a minimum height from the track for loading and a firm, non-tilting car-body when heavy stone is to be put in it. The track is about 4 feet gauge and all switches frogs, etc., are of good design, well located and kept in excellent condition.

The men are well housed and Chinese cooks are an innovation in contract work in this section of the country. These cooks, by-the-by, are an improvement too, for their kitchens were unusually clean for similar institutions, and we missed a certain familar, but not pleasant, smell usually found in contractors shanties.

Inside the tunnel the same careful attention to detail was evident; electric lights are used wherever practicable, and the men were working with a will as if they had some personal interest in the matter. The ventilation we found good everywhere, and we noticed that the air-conduits were very ample in size and well made; this ventilation is at present secured by a steam-jet, and the introduction of a small supply of compressed air at regular intervals into the air-conduit.

As to progress made, about 6,000 lineal feet of finished tunnel-section is completed, and all of the ten shafts on this contract are down and headings turned, except shaft No. 2; this last will not be in working shape for about two months yet, as it is one of the deep shafts. The rock is very hard in the headings, at 11 A, and 11 B. but full of seams and it is almost impossible to retain the normal tunnel section; as a consequence these slips run high into the roof in many places, while in others heavy timbering is necessary.

The tunnel-section is horse-shoe shape with extreme horizontal and vertical dimensions of about 16 feet, and normal quantity of 204 cubic feet per lineal foot of tunnel. The rock is worked with a top heading, with a bench of about 7½ feet in height, the standard being to keep this bench within 20 feet of the face. Four Ingersoll drills are worked in the heading on two drill-columns placed about 8½ feet apart, and two drills on the bench. The character of the rock is such that 5-foot holes are the rule, experience having shown that deeper holes are wasteful of powder and time. Twenty-one 5-foot holes are put into the heading in one shift and fired, or allowing for drift of holes, about 126 lineal feet of drill-hole. Giant powder is used as an explosive. We append a record of monthly progress taken from the official measurements of the engineers, in several of the shafts where the work is sufficiently advanced to make a showing.

	Date.	*Bench.*	*Heading.*	*Track. Laid.*
Shaft 11. B.	June 24.	273 ft.	296½	252½ ft.
" "	July 24.	455	476	435
" "	Aug. 24.	679	698½	645½
" "	Sept 20.	872	892½	855½
Shaft 11A.	June 24.	437	456½	411
" "	July 24.	622	658	589
" "	Aug. 24.	880	898	860
" "	Sep. 20.	1097	1113	1078½

NOTE.—The lengths given show condition at the respective dates.

From this record months could be picked out that would exceed the figures given above though they would not conform with the official dates. For the week ending September 13th, 71 feet of heading were driven; and for week ending September 20th, 50 feet of heading; on September 10th, 14 feet of heading was driven, and on September 18th, 10 feet of heading and 5 feet of bench. Mr. McBean confidentally expects to surpass this very excellent record in a tunnel of this size when he gets fairly to work on the tunnel nearer Croton Lake, where the work is not so hard. In passing we might remark that the rock at shaft 11 B, included in the record given, is acknowledged to be the hardest on the line of the tunnel.

An Autumn Day's Excursion.

There is not a more pleasant excursion trip in the vicinity of New York, for the autumn months, than that over the Lehigh Valley R. R., to Easton, Bethlehem, Mauch Chunk, the Switch Back R. R. and Glen Onoko. "Autumn leaves upon the Lehigh" must be seen to be appreciated, and in addition to the delightful scenery along the railway, are the many places interesting to a person engaged in engineering work or in the development of the iron and coal trades.

An express train on the L. V. R. R. leaves from the Pennsylvania Central Station, foot of Courtland St. New York at 8.10 A. M.; the cars are all first-class and comfortable, and for twenty-five cents extra a chair car can be had to Mauch Chunk. At the Musconetcong tunnel the hill country is entered, and for the remainder of the trip the excursionist can enjoy the pleasure of some most exquisite mountain scenery. At Phillipsburg, N. J., where the Delaware joins the Lehigh river and separates New Jersey from Pennsylvania, the extensive shops of the Warren Foundry and Machine Co., are located; the Lehigh Coal and Navigation Co's canal locks and planes are deserving of notice; there are more large railway and

highway bridges of iron and wood brought close together for study than can possibly be found elsewhere in America, and across the river is Easton, a quaint old city on the hills, with Lafayette College, the Glendon and other furnaces, and some delightful landscapes from the College grounds, to invite a visit from the tourist who has half a day to spend in the neighborhood.

From Easton to Bethlehem, and indeed to Mauch Chunk, is an almost continuous settlement, so close together are the villages and towns. The Glendon furnace is in blast, and the stock of iron now piled up on the canal bank all the way to Easton, is being diminished by two boat loads per day. But it is not a booming time among the furnaces, few of them showing signs of any activity. At Bethlehem, the Iron Works Company are keeping their fires and machinery active; work on the big blowing engines is, we believe, suspended, for a time; Supt. Fritz is back from his European vacation, and is still in command, and the company are reported as erecting plant for the making of big guns for the government, in case such an order should be found a necessity. Bethlehem is one of the oldest towns in the country, and a day there can be profitably spent. It is divided into North and South Bethlehem by the river; on the south side are the extensive works of the Iron Company, the Spiegeleisen furnace, and the fine buildings and grounds of the Lehigh University, now well endowed by the liberality of its founder, Asa Packer, and his children, and which has already won first-class rank as a school of engineering, by reason of its excellent corps of teachers, by its unequalled location for outdoor study in practical engineering, and by its relation to the great railway, whose principal owner was its founder.

The Bethlehem water works, the oldest in America, built originally in 1754, and bought by the borough in 1871* are having a new reservoir and pumping engine added, together with improved distribution, to meet the increasing demand for water; the fall term at the college opened last week with increased numbers in the classes, and the hundreds of students in attendance, help to enliven the old town.

Bethlehem is the headquarters of the Moravians, an orderly, law abiding, industrious and exceedingly economical people. The borough is governed by Councils, which divides the care of affairs among its committees. The road committee has charge of the Engineering department and feeling quite unable to cope with the difficulties of street improvement and sewerage, they have employed an ambitious young *attorney* to perform the duties of "City Engineer," who for $3,00 per day and the same rate for fractions thereof is performing the characteristic duties of his legitimate profession—muddling things generally, so far as public works are concerned. The civil engineer who is now building the water-works reservoir was a candidate for the office, as an advertising adjunct to his regular business; but the attorney was too much for him and secured the place. It was, however, proposed to elect an engineer resident to Councils and to place him on the road committee so that a consulting engineer could be had without cost to the borough. But the engineer citizen could not see it.

The Phœnix Bridge Co., is just completing a single track through bridge for the L. & S. Division of the Philadelphia & Reading R. R., at Bethlehem, Pa. This bridge consists of three spans of 146 feet 0 inches from center to center of end pins, and crosses the Lehigh River at such an angle that the skew of the bridge is 9 feet 3 inches in the width of 16 feet 0 inches between the centers of trusses. Like all the iron bridge work constructed for the P. & R. R. R. this structure is designed for the heaviest locomotives, giving a concentration of 96,000 pounds on a base of 14 feet 9 inches moving at the high rates of speed required by the traffic conditions of this road.

Phœnix columns are used for all compression members, and although the bridge has a considerable skew, inclined end posts with unusual heavy portal bracing secure great lateral stiffness.

While this bridge is without extraordinary dimensions it is in all respects of design and quality of material one of the most substantial railway structures recently built.

Mauch Chunk "the Switzerland of America" is an irregular collection of houses hung to the mountain sides or crowded into the narrow space between. The principal feature of the place is the everlasting procession of coal trains, winding along the valley, on both sides of the river in front of the principal street of the town. It was in this vicinity where anthracite coal was first mined, and it is now the gateway to the principal anthracite mining region of the country. It is the region of coal mining, breakers, mining towns and railways, Molly Maguireism and all that relates to the traffic in "black diamonds."

But aside from the picturesque scenery of this locality, the Switch Back R. R. is the great attraction of Mauch Chunk. It is not necessary to describe again this much described railway. To make use of a now somewhat familiar Canadian word, a ride over the Switch Back is "tobogganning" on wheels down two long inclines of over nine miles each. If the speed is not quite so rapid as on the snow planes, it is yet surrounded with such elements of danger as to make it sufficiently exciting for ordinary nerves. Only one accident, however, has been recorded against it, and that was the result of pure carelessness of an employé and not to anything pertaining to the road itself. The travel over the road is increasing every year and the lessees, the Messrs. Mulford Bros. have a comfortable "bonanza" in their unique attraction.

The L. V. R. R. Co., has expended a large sum of money in making Glen Onoko, two miles from Mauch Chunk, accessible and attractive. A train runs to it every hour from the latter station; an excellent foot path has been constructed along the sides of the Glen, seats provided in abundance, and a visit to this beautiful spot, with its many pretty cascades to be admired on the way up, and the fine landscape from the summit of the mountain, is well worthy of a visit.

This is the proper season for an excursion to the places above described. One cannot climb mountains with comfort in hot weather, and the beautiful coloring of the forests is to be seen only in autumn. The L. V. R. R. has arranged cheap excursions from New York, costing only $2.25 for the round trip; but it is a better plan to take two days and enjoy a really very valuable and enjoyable excursion.

*See Croes' History of American Water Works in ENGINEERING NEWS, April 20, 1882.

The Liebhaber Process for Cleaning the Face of Stone Masonry.

Les Annales des Travaux Publics, for Sept. 1885, contain an account of the successful experiments of Baron Liebhaber in cleaning the walls along the banks of the Seine in Paris, in 1884.

These walls, in the course of years, showed faces covered by a glistening black substance that repelled acids and required a special treatment for its removal. The first step in the cleaning process was to cover the face of the wall with a caustic paste made of a mixture of soda and ground lime. These substances were reduced to a honey-like consistency, and a little chloride of lime or perchloride of iron added. The paste was applied to the wall and allowed to remain for two or three hours according to the condition of the surface, the nature of the stone, and the state of the atmosphere. When it was removed the face of the masonry was still black but it had become sensitive to the application of acids.

After this preliminary treatment, the face was cleaned as follows: A workman with a large brush made of gutta-percha, coated the surface with a mixture called *sulfochlorhydrique*, which made a paste upon the stone, and immediately, with a two-pointed injector, he directed upon this paste a jet of the same liquid. This paste was allowed to act upon the wall for about two or three hours; then came workmen who brushed off the portions of the wall-face where the acid had finished its work and ended by washing down the face with a strong jet of water from a force-pump.

The *sulfochlorhydrique* is composed of sulphuric and chlorhydric acid; the proportion is empyrical but corresponds about with the following formula:

$$\left.\begin{matrix} Cl \\ SO^4 \end{matrix}\right\} H, 16\,H\,O$$

This composition varies slightly with the nature of the stone and the inclination of the surface.

In the Paris experiments the cost of thus cleaning the river walls was as follows: The cost of coating the surface was 46 centimes per square metre, and the labor was by contract at 50 centimes per square metre, while the washing and cleaning with sand and pure water would cost 45 centimes per metre. The results thus obtained were completely satisfactory. For the portions of wall which had first to be treated with the caustic paste, an additional sum of 50 centimes per metre was paid. The new process thus cost from 1 franc to 1 franc, 20 centimes, per square metre; about one-half the cost of the former method of cleaning these walls.

PERSONAL.

JEAN CLAUDE BOQUET, the well-known mathematician, died at Paris.

MR. SAMUEL ABBOTT, M. Inst. C. E,, of Lincoln, Eng., civil engineer and surveyor, is chief resident engineer to the Buenos Ayres Great Southern Railway.

E. E. MYERS, the Detroit architect, is to be the designer of the new $1,000,000 state capitol at Denver, Col.

G. R. TALCOTT, superintendent of the Columbia and Greenville division of the Richmond and Danville road, has accepted a similar position on the Mobile and Ohio road.

WM. SHELFORD, engineer of the Great Eastern Railway of London and Consulting Engineer of the Winnipeg and Hudson's Bay Railway, accompanied by R. J. MOONEY, his assistant, has arrived at Winnipeg, Manitoba, for the purpose of investigating the feasibility and cost of building a railway to Hudson's Bay.

One of M. ALPHAND'S chief lieutenants was M. COUCHE, the engineer-in-chief of the water-works of Paris. The great reservoirs at Ivry, Villejuif, and Laforge were constructed from his designs, and he introduced many improvements of his own invention in connection with the distribution of the water. We regret to hear that M. COUCHE has been drowned at Jersey in vainly endeavoring to save his son, a lad of fifteen. He was fifty-three years of age, and had been for a great part of his life in the service of the Municipal Council of Paris.—London *Architect*.

ARTEMUS MARTIN, recently appointed head of the computing division of the United States Coast Survey, is remarkable as being one with whom the love of mathematics has been a lifelong passion, and to whom the study of that science has brought fame and at length

public office. He was born in Stuben county, New York, but spent his boyhood in Venango county, this state. His early schooling was meager, but at fourteen his mathematical passion seized him, and thenceforth all his spare time was given to the study of figures. He contributed to the mathematical department of various periodicals and figured in the columns of the Philadelphia *Saturday Evening Post* for nearly twenty years. Yale College conferred on him the honorary degree of master of arts in 1877, and in 1878 he was elected a member of the London Mathematical Society. In 1882 Rutgers Colleg econferred on him the Ph. D., and in 1881 he was elected a member of the Mathematical Society of France. In 1881 he refused a professorship in a normal school in Missouri. He contributed to the *Analyst*, to the *Messenger of Mathematics*, Cambridge, Eng., the *Educational Times*, of London, and to a score of domestic periodicals.

MONSEIUR D. BANDERALLY, engineer-in-chief of the Northern railway of France, and MR. LEWYT, his assistant, are in Pittsburg for the purpose of observing the Westinghouse system of train signals and switches in use by the Pennsylvania road.

IT is now reported that, at a late meeting of the directors of the Milwaukee, Lake Shore & Western Railroad, H. L. WHITCOMB was appointed general manager of the road, E. H. RUMMELE chief engineer, and F. W. RHINELANDER, Jr., assistant to the president.

WILLIAM KERRIGAN has been appointed general superintendent of the Missouri Pacific system. MR. KERRIGAN is one of the oldest superintendents on the road, having been on the Iron Mountain ever since and before it came into the possession of Mr. Gould, and is regarded as one of the most capable men connected with the system.

The new Chicago firm of railway and civil engineers, Messrs. A. GOTTLIEB & Co., was organized in May, last, succeeding Messrs Edward Hemberle & Co., and retaining the offices of the latter concern in Major block, corner Madison and La Salle streets. MR. GOTTLIEB has already become well known in the field of bridge construction and architectural work, having been for seven years president, and, at the same time, general manager and chief engineer of the Keystone Bridge Company of Pittsburgh, and was actively connected with all the work of that company during the period named. Among the structures designed or superintended by him are the railway bridge over the Ohio river at Point Pleasant, the immense steel bridges over the Missouri river at Plattsmouth and Blair and the Baltimore and Ohio bridge over the Susquehanna river. MR. GOTTIEB furnished the plans for the iron light house, 150 feet high, at Tampico, Mexico. The mining pavilion of the Mexican government at the recent New Orleans exposition was designed by him. It was of the Moorish style, and the delicate effects of the lace-like iron work were much admired. The firm is now engaged on bridge work for the Chicago, Burlington and Quincy, the Pittsburgh, Fort Wayne and Chicago and the Louisville, New Albany and Chicago roads, and also upon several large iron roofs in Chicago and elsewhere. Mr. M. Lerfort is associated with MR. GOTTIEB in the new firm.—*Railway Age.*

WOOD CHARRED BY STEAM PIPES.—There is actual proof that wood can be charred by steam pipes, and by the slow but long-continued action of moderately-heated steam. Charcoal thus formed is said to be liable to absorb oxygen suddenly, and break out into spontaneous combustion. It is wisdom to have an eye upon the surroundings of the steam register.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page* 188).

As to actual labor in doing the work, the first step is to distribute the ties where they will be needed, then if the ballast is sloped away from the rail as was recommended, the work is easy, although it must be performed with passage at all times safe for trains. With sloped ballast all the digging that is necessary is between those ties to be replaced so that they can be drawn out easily, while if material is packed up around the ends of the ties, it must be removed in addition. Having done the necessary digging, start up the spikes for a rail length pulling entirely one-half of them, then block up the rail with a spike or bit of gravel, draw out three or four ties, smooth off the bed, put in new ones, half-spike them and then proceed to remove the remainder. Always keep the track safely spiked and full spike it as soon as possible. The spikers should be provided with a small stick cut to the length of the projection of the tie beyond the base of rail and every tie should be gauged by this stick before being fastened. Spikers should also see that no ballast or other obstruction is between the rail and tie, and that the former bears true on the latter, and if it does not, then the rough surface of the tie is to be adzed even. If the track is to be newly ballasted and raised at the same time, then before changing the ties the track should first be lifted and ballast packed under the tie-ends sufficient to hold the track in place, after which the ties can be easily drawn out, and replaced without digging or hard pulling. After the ties are changed then fill in and complete the raising. If weather promises fair, men can be allowed to work for two or three days simply changing, and then return to fill in and surface, for this will give a longer stretch to sight over, and so a better chance of getting it done correctly, besides expediting the work. If, however, bad weather is probable, it is better to close at night each day's work. At the end of the day the old ties should be gathered together and placed in piles and removed from the right of way or burned at an early date. Nothing is more unsightly than to see the road-bed and ditches encumbered with old rotten ties, and beside the traveling public is too apt to draw an inference that they are but samples of which there are many more still in use, for unfortunately the patrons of our roads have, as a rule, but a faint conception of the work performed and how the vast amount of property in the hands of maintenance of way men is taken care of. When putting in ties the ability of a foreman to properly handle and dispose of his gang is soon shown. He should so distribute his force that the men are far enough apart not to be in each other's way and yet be close enough for him to watch and control. With gravel ballast, each man in a gang should average, including surfacing, from twelve to sixteen ties per day's labor according to the facilities of the location for their removal.

It is also to be remembered that ballast suffers by use as well as other material, and should be removed from time to time. The best way to do this is to work at it continually rather than to handle it at intervals, which makes it more costly. If then new ballast is distributed in small quantities each year, it should be done if possible in conjunction with changing ties, so that the one tamping will answer for both and leave the track in condition to run, with the exception of small repairs, until the next re-tieing.

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It is one thing to bring track to good surface and another to have it remain so, but the secret of the latter is tamping, for unless track is well tamped it will not stay.

Ties should be tamped their whole length and all should be tamped alike except frog and joint ties which require harder work. Although the operation of tamping with the bar is slow, yet its use should be insisted on as economical in the end and the shovel allowed only in sufficient or temporary work. From the end of the tie to about one foot inside the rail the ballast should be packed hard and solidly, the tampers working in pairs so as to strike both sides at the same time and keep the material from being driven out from under. The ballast between these joints, that is in the center of the tie, can be packed less hard and for this the shovel may be permitted. If the center is tamped too hard, the tie will be supported there when the ballast settles under the rail and is liable to be broken, while on the other hand if the center is not sufficiently tamped, it makes a sort of blind drain into which the surface water runs and softens all the rest of the work. No matter how hard new ballast is packed it will settle and to allow for this, track being raised, should be put from ¼ to 1 inch high according to the amount of the lift and newly raised joints should crown from ¼ in. to ½-in. for the same reason. If the raise is considerable or track new, it is just as well with first surfacing to tamp with shovels, because it will settle no matter how carefully done, then after trains have packed it down so that settling has ceased, go over it again with bars and work will then be permanent.

Track foremen when at work should notice the effect of all passing trains, and especially their action upon the joints. Track well tamped will deflect but little, and that little will be uniform, while poorly tamped track although in good surface immediately before and after the passage of a train, will yield during this time considerably and unevenly; this action materially assists the rail to cut into the ties and the spikes to work up and get loose.

Ties beyond the joints should be watched because the loosening of these ties has a damaging effect on the splice-bars as previously explained.

Before winter, it is well, in yards, to tamp frog-ties and head blocks (if stub switches are used) to prevent water settling under them, although it is not advisable, as a rule, to disturb the solidity of the road-bed just previous to frost.

It is for every reason best when raising or lining track to do so with aid of an instrument, provided the quantity of work extends beyond ordinary small repairs. Thus for alignment set plugs, making the track center every fifty feet to one hundred feet as was mentioned above; and for surface, grade stakes at about the same distance, these stakes giving the level to which the top of the rail is to be raised.

On tangents they can be set on the most convenient side of the track, but on curves they should be next to the inner rail so that foremen can adjust the track opposite each stake with his spirit-level and then raise the intermediate portion by eye. By this setting of stakes the foreman is allowed to be with his men and not at a distance sighting along the rail; the men are kept continuously at work, and are not obliged to wait at intervals for him to gauge, the proper elevation by his eye; while above all the work is not only performed quicker but more accurately.

In case an engineer cannot be had to give grade stakes, each foreman can make a level board for himself, which will give better results than his eye alone. Let him take a board five feet to six feet long by twelve inches wide, paint it with three longitudinal stripes, each four inches wide, the lower and upper

ones black and the center one white. Then get the blocks about 6 in. × 6 in. × 6 in., cutting a groove down the center one inch deep, and as wide as the rail-head so that they will set over the rail like a saddle and be just four inches above it. The striped board is placed across the track at one end of the piece to be raised and propped, the track having first been levelled transversely. The foreman then retires to the other end of the stretch, setting one of the blocks on top of the rail by him, while the other block is placed at successive intervals between him and the level board. He then sights over the top of the first block at the bottom of the white stripe and directs the track to be raised until the top of the intermediate block just touches the line of sight. That gives one point to grade and similar repetitions raise the whole sag to where it should be. The two rails are then adjusted transversely by means of a spirit-level.

TO BE CONTINUED.

CORRESPONDENCE.

Something New in Engineering.

PORTAGE, WIS., Sept. 21, 1885.

EDITOR ENGINEERING NEWS:—I am a subscriber of your paper and so apply to you as the most reliable source for the following information if it is possible for you to give it to me. What I wish to know is this—How to find the amount of hay (in tons) when in the stack? I encounter it stacked in two ways—with length and width—and rounding top—again with base round, and you might say, cone shaped.

The first can easily be measured for length and width—also over the top from ground to ground both lengthwise and across. The second can be measured around on the ground, giving the circumference and also the height from which we can determine the bulk.

If you can tell me how to handle this I shall be greatly obliged. Very Respectfully,

C. P. R.

[This problem looks simple enough, but as we have had no personal experience in measuring a hay-stack, there may be "allowances" etc., of which we have no knowledge. Will some one of our posted readers reply? Howell says, hay, loose, weighs 5 lbs. per cubic foot; ordinarily pressed, as in a stack, 8 lbs. ED. ENG. NEWS.]

Boston Main Drainage.

MASSACHUSETTS DRAINAGE COMMISSION,
OFFICE OF ENGINEER, 74 TREMONT ST.,
BOSTON, Sept. 21, 1885.

EDITOR ENGINEERING NEWS:—Although I have not been connected with the engineering department of Boston for the past six months, and am not responsible for the method of distributing my book on Boston Main Drainage, I am sorry that there has been occasion to find fault with the way in which the sale was effected. The book was printed by the city for gratuitous distribution. A few hundred copies were sent to leading engineers, libraries, etc., and the remainder of the edition was to have been divided among the City Council. At the suggestion of the engineering department one hundred issues were put on sale at a price which was intended simply to cover the cost. This was done as the only means of affording an opportunity to engineers who did not receive the book, of obtaining copies which would otherwise have found their way into the hands of those who merely took them because they could get them for nothing. If the sale has been effected in an unsatisfactory manner, it is because it was necessarily conducted by city clerks unused to such business. I am informed by the City Messenger that the edition is exhausted.

Very respectfully,

ELIOT C. CLARKE.

[Parties accustomed to the methods of business transactions by city officials can fully appreciate the above explanation of Mr. Clarke. The City of Boston is not in the book trade, and the City Messenger probably had no "appropriation" for prepayment of postage. The well deserved popularity of Mr. Clarke's book has resulted in a speedy disposal of the entire edition; it may be consoling to would-be-purchasers, however, to know that at a late meeting of Council another edition of 1000 copies was authorized to be printed; this will not probably supply the demand, but a third edition is not likely to be authorized. We advise every engineer to secure a copy while he can; the price is a nominal one, and to save trouble enclose the postage—12 cents—for the return of the book. When the city stops selling, the book will double in price.—ED. ENG. NEWS.]

The Institution of Permanent Way Inspectors.

The Council of the Institution of Permanent Way Inspectors invite papers and communications, for reading and discussion, at meetings during the year 1885, upon the following subjects, submitted by Mr. A. Hamilton-Smyth.

1. The system adopted by different railway companies for controlling the distribution and consumption of permanent way materials for repairs, and for regulating the sale or consumption, for secondary purposes, of materials when worn out.
2. The relation the number of men employed in the maintenance of the permanent way bears to the amount of the traffic on various railways.
3. The practical rules for the regulation and instruction of the permanent way department on various railways, with suggestions for their improvement.
4. The compilation of practical statistics of permanent way maintenance, and the use of graphic diagrams of statistics.
5. The systems of reporting on the condition of the line and works, and stock of materials used by permanent way inspectors on various railways.
6. The comparative advantages of the systems of outside and inside keying of chaired rails.
7. The comparative advantages of suspended and supported jointing of rails.
8. The widening of the gauge or curves of various radii.
9. The practical means adopted on various railways for insuring correct super-elevation of the outer rail on curves, relative to the greatest speed of the trains running over them.
10. The stiffening of the rail-joints by the use of deep or angle fishplates.
11. The comparative advantages of bull-headed or double-headed rails in chairs, and of flat-bottomed rails with or without soleplates.
12. Practical experience of the economy and efficiency of various systems of lock-nuts or washers for fish-bolts.
13. The effects of various kinds of ballast on the lines of rails and sleepers.
14. Steel and iron sleepers.
15. The effects on permanent way of defective rolling stock working on it.
16. Various systems of surface drainage of permanent way.
17. The economy, security, and maintenance of various systems of railway fencing.
18. Mechanical appliances used for lifting the rails on the line.
19. The use of mechanically-worked lorries for inspection purposes.
20. Simple appliances in use on railways for assisting the eye in levelling the top surfaces of the lines of rails.
21. The several duties and responsibilities of the plate layer, the signal fitter, and the signalman with regard to the maintenance of interlocked points and their connections.
22. Details of renewals of points and crossings at busy junctions without obstructing the regular traffic.
23. The comparative advantages of the systems of working facing-point locks by the same lever that works the facing points, and of working facing points and their locking bolts by separate levers.
24. The systems adopted by various railway companies for providing medical attendance to members of the permament way staff residing at a distance from stations, and the rules for allowances of pay while sick.
25. The systems adopted by various railway companies for the maintenance of buildings at roadside station.
26. The comparative advantages of tolerating or of preventing trespass by the public on railways in remote districts, and the practical means adopted for the latter.

Communications are to be addressed to Mr. Robert Macriott, the honorary secretary, at the offices of the Institution, 5, Nettleton-road, Gloucester.

A METALLIC TELEGRAPH POLE has been adopted, it is said, by the Canadian government for its telegraph lines on the Northwestern prairies. The pole is constructed of malleable galvanized iron, and is 1¼ inches in diameter at the top, and 2½ inches in diameter at the bottom, and weighs less than fifty pounds. The bottom of the pole is set into a claw-plate, upon which the earth is closely packed to a height of about two feet. Then another plate is put into place around the pole, and the earth packed upon it to the level of the ground. The claw-plates take a hold in the ground at once, so that the pole becomes solidly fixed immediately after being set, which desideratum is only obtained by the ordinary wooden pole after it has been in the ground for at least a year. A recent test is said to have shown the great strength of the pole, as a heavy No. 6 government wire was strung and the poles subjected to the greatest possible strain, but without moving them in the least.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY JAMES B. CROES, M. SOC. C. E.; INST. C. E.

(CONTINUED FROM PAGE 155)

DCCLXXVIII. TIDIOUTE, PA.

Tidioute, Warren Co., Pennsylvania in lat. 41° 50′ N., long. 79° 20′ W. Water-works were built in 1871, by a private company, the supply being taken from a small mountain stream fed by springs across which a dam is built impounding the water. From this reservoir the water is conveyed to the distributing reservoir in the town four miles distant, holding 520,000 gallons, and having an elevation above the town of about 160 feet.

Distribution is by 7 miles of cast-iron pipe with 23 fire-hydrants and 111 taps. No meters are used. Service pipes are of galvanized iron and lead. The borough pays $500 yearly for fire service. The daily consumption is not known.

The works have cost $40,000. The bonded debt is $1,600 at 6 per cent, and $1,400 at 5 per cent. The yearly expenses of maintenance are $600. The population in 1880 was 1,255. Z. M. Jones is President, W. R. Dawson, Secretary, and S. Zipton Superintendent.

DCCLXXIX. UXBRIDGE, MASS.

Uxbridge, Worcester Co., Massachusetts in lat. 42° 5′ N. long. 71° 35′ W., 18 miles S. E. of Worcester has large cotton and woolen manufactories.

Water-works were built in 1880, by the town after plans and under the direction of A. W. Bennett. The supply is taken from a number of springs, yielding 40,000 gallons daily, from which the water is brought in covered trenches from 6 to 10 feet deep to a basin 10 by 6 feet deep, and passes thence to two reservoirs, the first of which is 80 feet long, 60 feet wide and 10 feet deep, and the second 28 feet in diameter and 15 feet in depth, 137 feet above and ¼ a mile distant from the town to which it is conducted in 6 inch cast-iron pipe.

These reservoirs are covered and all surface water excluded. Distribution is by 3 miles of cast-iron pipe with 20 fire-hydrants, 2 meters and 100 taps. Services are of wrought-iron. The daily consumption is 2,000 gallons. The town pays $50 yearly for fire service. The yearly expenses of maintenance are $1,000 and the receipts $2,000. The cost of the works has been $20,000. The bonded debt is $10,000 at 5 per cent. The population in 1880 was 3,111. A. W. Bennett manages the works.

DCCLXXX.—UXBRIDGE, ONTARIO.

Uxbridge, Ontario Co., Ontario, Canada, in lat. 44° 15′ N., long. 79° W., is on the Toronto & Nipissing R. R., 43 miles from Toronto, and has important manufactures.

Water-works were built by the town in 1874, taking the supply from surface water. The water is pumped from a stream directly into the mains by a Holly force pump, and is distributed by one mile of 6 inch cast-iron pipe with ten fire hydrants.

The works are for fire protection only, and have cost $10,000. The yearly expenses of maintenance are $200. The population is 1,500. W. McGuire is engineer of the works.

ERRATUM.—In issue of Sept. 5th., page 155, DCCLXXVI, *Springfield*, Maine, should read *Springvale*, Maine.

WATER

NEWTON, KAN., is to be supplied with gas.

DALTON, MASS., is pleased with its water works.

ADAMS, N. Y. water works were satisfactorily tested.

DICKSON CITY, PA., is soon to have water works.

GRAND ISLAND, NEB., has voted for water works.

NEWARK, Wayne Co., N. Y., propose to have a steam fire engine.

FARNHAM, QUE., is about to build water works. Bids were opened yesterday, 25th.

THE reservoir of the Bridgeport, Conn., water works is being cleaned.

THE CHERRY VALE, KAN., water works construction is progressing favorably, in spite of wet weather.

THE South Side Water Works Co., of Pittsburg, Pa. are trying to sell out to the city for $3,000,000.

WATER works are to be built at Valley Falls, N. Y. Thomas Lape, of that place, has the matter in charge.

THE City Council of Bristol, Tenn., contemplate erecting water works.

THE Town Council of Leechburgh, Pa., will at once issue bonds and borrow money to the amount of $12,000, for the purpose of erecting water works.

THE Mankato Construction Co., of Mankato, Minn., has been incorporated to construct and operate water and gas works.

THE Wilmington Water Power Co., of Wilmington, Ill., has been incorporated to hold water in the Kankakee river for manufacturing purposes.

TOPEKA, KAN. has awarded the contract for boring for coal to the American Diamond Rock Boring Co., of N. Y. 2,000 feet for $10,750. A Denver Co, bid $13,550.

MESSRS. WILLIAM R. GREENE, Robert Roech, and John J. Arnold, are the committee on new water works for Phenix, R. I.

THE artesian well for the Northampton, Mass., silk factory is now 1,200 feet deep, eight inches bore and no water.

NUMEROUS water producing artesian wells in Charlestown, S. C., contribute much to the health of that city. A new one to go down 2,000 feet has been projected.

ISAAC S. CASSIN and Howard Murphy, of Philadelphia, have been engaged to make the plans and superintend construction for the water-works of Woodbury, N. J. The cost of the works is estimated at $70,000.

THE South Bethlehem, Pa., Water Co., is extending its water-works. A new reservoir is in process of construction, and pumping engines will soon be bargained for.

THE town of Melrose, Mass., wants proposals for constructing a reservoir for its water works. The Water Commissioners of the place have the plans and specifications.

A NEW reservoir has been built at the Oakwood Cemetery, Troy, which is supplied from a newly discovered spring. There is a flow of 4000 gallons daily, and the water is used for drinking and sprinkling purposes.

THE West Troy (N. Y.) waterworks company has offered to supply Green Island at the rate of $2000 a year for eighteen hydrants. The village has offered to give $1800, but the water company will not lower its demands.

THE progress of laying the water mains on Ontario street, Cohoes, N. Y., will be impeded until the State authorities construct the new trestle over the Champlain canal.

JAMES BENEDICT, City Clerk of Arkansas City, Cowley County, Kansas, will receive bids for waterworks construction until noon of October 12th. Specifications forwarded on application.

SHERMAN & MCDONOUGH, of Troy, N. Y., have been awarded the contract to erect water works at Canastota, N. Y. Work will be completed by November 15, 1885.

SHELBYVILLE, IND., is to have a system of water works. Seventy-four hydrants and seven miles of mains, from six to sixteen inches, will be put in. J. B. Martindale, of Indianapolis, Ind., has been awarded the contract.

THE Woodside Sugar Refining Company, of Dartmouth, N. S., have submitted unofficially to the Council a proposition that that town be supplied with water from Lake Lamont, the cost being equally borne by the sugar refinery, the local government and the town.

WHAT appears to be Asiatic cholera or a disease almost identical with it is prevalent at Hantsport, N. S., a village of about 1,000 inhabitant. Several families have already lost children, and some adults have been carried off. Some of the residents have taken to flight. The water supplied by wells is said to be bad, and the drainage is worse.

UP to 9 o'clock on the 18th, the Signal Service rain gauge showed 17 90-100 inches rain fell in Galveston, Tex., since September 1. This record is without a parallel. The total rainfall at that point is 52.37 per year. It will therefore be seen that in eighteen days over one-third the annual rainfall had fallen.

A SUIT was entered on the 19th in the Superior Court of Mass., by W. C. Parker & Co., against the City of Boston, in which damages are laid at $100,000. The firm built the large storage reservoir at Moon Island, and they claimed that they did work not called for by their contract, to the amount of about $90,000 at the request of the late City Engineer Wightman.

A COMPANY has been formed at Phillipsburg, N. J., for the purpose of constructing a system of water works. J. C. Kent is president and John A. Bachman treasurer.

AMESBURY, MASS.—Charles Wing & Co., of this village have been awarded the contract for supplying the pipe for the new sewers, a part of which has already arrived.

THE Department of Public Works New York City will receive bids until October, 2nd, for laying water mains and furnishing cast-iron water pipes, stop cocks, hydrants, etc.

WASHINGTON, Sept. 23.—This city is suffering a water famine. A break of seven or eight square feet in size, has occurred in the principal main in Georgetown, and the materials are not in hand with which to make immediate repairs. The city is receiving only half the supply of water to-day.

THE Boston Council Common passed orders for the printing of 1,000 additional copies of the "Report on Main Drainage Works," with a digest of the action of the City Council in originating and prosecuting the work upon the system of improved sewerage; to build a main sewer between Crescent avenue and Greenwich street, at an expense not exceeding $65,000.

FOND DU LAC, WIS., Sept. 10.—The new well being bored here for the water-works has affected somewhat the flow of water in many of the fountains in the city. The well on the High school grounds has entirely stopped flowing. B. F. Moore's fountain, which supplies the La Belle wagon works and a number of residences, has acted badly, at one time not flowing at all and again yielding water. Other fountains are also affected.

ALLEGHENY'S WATER PROBLEM.—The sub-Committee of the State Board of Health made an examination of the north shore of the Allegheny river as far as Clare mont, September 19th. They think that the only practical solution of the pure water question is for Allegheny to remove its pumping station above Sharpsburg. The sewerage of the Work-house and City Home, they think, could be easily disposed of. They indorse the plan already proposed of erecting a reservoir back of the Work-house and a pumping station at the foot of Nine-Mile run.

SCHUYLKILL WATER DISCUSSED.—At the annual meeting of the American Forestry Congress in Boston, September 22nd, the President, Warren Highley, of New York, in the course of his address, made this reference to the Schuylkill water supply:

"For two years past the engineers of the Water-Works Department of Philadelphia have been making examinations of all possible sources of a suitable water supply for their city, and have lately discovered how seriously the Schuylkill, from which the water is now taken, has been affected by the destruction of forests around its headwaters. Sixty years ago the Schuykill's summer flow was estimated at 500,000,000 gallons a day. Measurements made from time to time showed a gradual diminution until 1874 the minimum flow was only 25,000,000 gallons per day. This is a well authenticated fact, and it is shown that the diminution has been caused by cutting the forests from the headwaters of the stream."

BROOKLYN'S WATER SYSTEM.—Mayor Smith of Philadelphia, and the Water Committee of Councils have returned from Brooklyn, where they made an inspection of the system which supplies daily from 33,000,000 to 40,000,000 gallons of pure cold water to the residents of that city. The system is that of driving gang wells, introduced by William D. Andrews & Bro. There are four pumping stations, known as Spring Creek, Paisley's, Forest Stream and Clear Stream, with a capacity of from 5,000,000 to 10,000,000 gallons each per day. The depth of the wells varies from 40 to 160 feet, and they are connected by a surface pipe to a sixteen-inch main. The water is drawn from the gang of wells by one engine. Duplicate engines are kept in case of accident. The wells are two-inch iron tubes, and as many as 110 are connected with a station. Steel casing covers the tubes, and at the lower end is a perforated jacket to exclude sand.

PROF. SAMUEL CABOT, a distinguished chemist of Boston who was employed by the Water Board to analyse waters from the Merrimac and different portions of the works, has submitted his report, which includes a tabulated statement of the result. The conclusion that Prof. Cabot draws is that none of the specimens submitted to him was bad, even that coming from the river direct being about one-half as bad as Cochituate water, which he examined and analyzed on the same date for a comparison. He considers Lowell water, therefore, to be a safe water until it grows worse, but advises that the albuminoid of ammonia which has settled in the filtering gallery and conduit be not allowed to increase. In concluding his report the Professor says he examined a piece of lead pipe which had been exposed to the action of the water for many years and found it entirely uninjured. This was owing to the fact that the water was of such a composition and softness that it could have no corrosive action upon the lead.—*Lowell Times.*

WORK on the new water-works, at Mattoon, Ill., is being pushed towards completion. Seventy-five hydrants. The supply of water will come from ten tubular wells sunk only to the depth of fifty-five feet. The works when completed will cost $80,000, and the city will pay an annual rental of $5,000. C. D. Barstow of St. Louis is superintendent of construction.

THE Empire Gas Works Construction Company of New York, has been incorporated with the following incorporators and trustees, viz.: Reinhold Boeklen Israel Cook, Edward S. Benedict, and Benjamin H Woodworth, of Brooklyn, and Robert M. Potter, of Jersey City. Its objects are the construction and alteration of gas works, and all business pertaining thereto. Capital stock, $500,000, divided into 5,000 shares of $100 each.

THE greatest gas well in the world has been discovered at Ludlow McKean county Pa. Gas was found on the farm of John Henderson last week, after a very deep well had been dug. The noise from the escaping gas is so piercing that is almost impossible to remain about the derrick. The shops and manufactories at Ludlow, shut down, to enable their employes to see the wonder. Gas was found at a depth of 1,513 feet, and drilling was continued until the power of the gas became so great, as to hold up the drilling tools.

IN his instructions relating to sewer construction, Sir R. Rawlinson observes that Portland cement and lias limes, makes good hydraulic mortar. The proportion of cement or of lime to sand, should not exceed two and a half parts of clean, sharp sand to one part, by measure, of ground Portland cement or lias lime. If clean furnace ashes or slag should be available, there may be two parts of sand, and one-half part of ashes or slag employed, the whole to be mixed in a revolving pan, each panful to have twenty minutes' grinding. In making mortar or concrete, it is of the utmost importance to use clean materials. The water for wetting bricks and for mixing mortar or concrete, ought to be free from salt.

THE idea of a fire protection is a grand one, and lessens the rate of insurance. This is attained by a proper system of water-works, but the right down, every-day good to the people is where its principal value comes in. The small expense at which the residents of villages can be supplied with water in their dwellings, yards and grounds, and the many conveniences which arise therefrom, are obtained by such a system. A dwelling can thus be equipped with all the conveniences obtained in cities at a much smaller cost, and with water selected from the purest and best sources of supply in the neighborhood.

WISE CITY FATHERS. To deter boys from climbing the telephone poles at Fond du Lac the plan of attaching wire to the spikes and connecting them with a battery was conceived, and it worked to perfection. The first day no less than 200 boys attempted to climb the pole, but immediately received such a shock that they retreated in dismay. Later however, a farmer drove up to the pole and hitched his horses. One of the animals unsuspectingly caught hold of the spike, and immedialely there was a start and a jump and the hitching strap snapped and away went the team. The farmer suffered the fracture of three ribs in attempting to stop the runaways, one or more women were run over and the wagon smashed to atoms.

SHOCKS IN WATER PIPES.—The water pipes in a building often prove a nuisance by transmitting with noisy effect the various shocks and vibrations in the water pressure. A pump used for the purpose of supplying the hydraulic pressure which operated the elevators in a building in New York, could be heard over the building, each water-pipe giving a sympathetic tremor with every stroke of the pump. After the failure of many attempts to reduce the noise by charging the mechanism of the pump, the difficulty was solved by removing about 2 feet of the discharge pipe, and substituting a piece of rubber hose, which seemed to appropriate in its dilation, the variations of water pressure.

THE Adams, N. Y., water-works were satisfactorily tested on the 19th. The water is brought from natural springs. A Worthington pump, capacity 1,000,000 gallons, forces the water into a wrought-iron standpipe 40 feet high, 15 feet diameter, and capable of holding 55,000 gallons of water, and situated at an elevation of 160 feet above the business portion of the town. Direct pressure is also used in case of fire. At the test on Saturday a stream was thrown 200 feet high, with a stream pressure of 80 lbs., and through 100 feet of hose. The Adams water-works company is officered as follows: F. A. Hinds, President; D. A. Dwight, Vice President; George W. Hannahs, Treasurer; H. C. Hodgkins, Secretary. This company furnishes the village fire protection through twenty hydrants at the low rate of $1,070 per year, guaranteeing at all times to have the hydrants in working order. The hydrants were manufactured by the Eddy valve company, of Waterford; and the cast-iron mains are from the Warren foundry, at Phillipsburg, N. J.

Hinds, Moffett & Co., of Watertown were the Contractors.

THE Watertown, Mass., Water Co., will extend their street mains.

R. D. WOOD & Co., of Philadelphia, are now filling a contract for 20,000 tons of cast-iron gas pipe for a natural gas company in Pittsburg. This is said to be the largest contract for cast-iron pipe ever given out at one time.

THE Second National Bank of Hillsdale, Mich., took the entire amount of bonds issued for the building of the Water Works for that place. The amount is $45,000 and they run twenty years. They bear four and one-half per cent. interest.

CITY ENGINEER BIGELOW, of Pittsburg, Pa., has prepared plans for a combined system of sewage for Negley's run, Four Mile run, Two Mile run and Cunliff run of that city, and the sewers are to be built if the bids are low enough. The estimated cost is $137,000, $30,000, $120,000, and $14,000 respectively. Brick sewers.

THE formal test of the Muncie, Ind., Water Works, made on the 15th appear to be satisfactory. A pressure all the way from 125 to 160 pounds was carried for almost ten hours. With five hundred feet of hose, the company succeeded in throwing seven streams at the same time through an inch-and-a-quarter nozzle, 110 feet high, and four such streams much higher.

CHAUNCEY HURLBUT, late of Detroit, directs by will that $50,000 of stock of the Detroit National Bank shall be given in trust to the Water Board of that city, the income to be used in beautifying the Pumping House grounds and to enlarging the library of scientific works also bequeated to the Water Board by the deceased.

BRUNSWICK, GA., September 12th.—The Jester-Boardman water and gas contract was confirmed to-day by a vote of nine to one in favor of the contract, the vote standing 272 to 29. By the terms of the contract, the new company is to supply the city with water and gas. The water will be furnished from artesian wells, and work will proceed at once.

A BLACK lizard, or "water dog," came through a Chicago hydrant one day last week. It was 9½ inches long; 1¾ broad, and one inch thick. It can manage to survive in muddy or filthy water, and evidently came from the Chicago River and thence through the crib to the water plug. Its bite is said to be poisonous. As it lay on a marble slab it seemed to offer a passive contradiction to the assertion about Chicago's pure water.

IT is stated that it will cost the town of Framingham, Mass., from $300,000 to $500,000 to provide a suitable system of sewerage. The malarial trouble recently appearing in the vicinity has a tendency to make people fearful for the future, and it is thought by many that the city of Boston should be obliged to pay heavy damaged to people who have suffered by the drawing off of Farm pond, if such is proved to be true.

WATER FROM BELOW THE SEA.—Nearly three years ago the Lackawanna Iron and Coal Company began to sink an artesian well not far from the main works of the company. Geologists expressed the opinion that a constant flow of water could be obtained by boring 1,000 feet. The work was carried on under the supervision of William McEachan. The diameter of the hole was eight inches. At 1,600 feet there was no indication of water. The drill had gone several hundred feet below the lowest coal deposit, and had passed through strata of sand, conglomerate and clay. The well had then reached a depth of nearly 300 feet below the sea level. For months thereafter the drill was kept busy. Recently it touched a point 2,100 feet below the surface and water was found. It rose to the top of the well, but the overflow was so small that there was no prospect that its volume would be sufficient to supply the mills. The company concluded to abandon the work, and ordered the machinery to be removed. Mr. McEachan, however, advanced the theory that water in abundance arose from the bottom of the well to a soft stratum a short distance below the lower vein of coal, through which it flowed away to the south. He prevailed on the officials to let him try an experiment. He believed that the flow of water would be greatly increased if the well was tubed from the top to a point below the soft stratum. A few days ago the tubing was completed and immediately an eight inch stream of water spurted seven feet above the surface and has continued to do so ever since.—*N. Y. Sun.*

WORCESTER, MASS., SEWAGE. The Millbury Grange, P. of H., No. 107, call the attention of their fellow patrons of the State of Massachusetts to the following statements of facts and resolutions:

In accordance with an act of the legislature of 1867, the city of Worcester adopted the present system of sewerage. That system consists in the use of Mill Brook, which runs through the heart of the city, to carry her sewage into the Blackstone river. This small stream, in many places not 20 feet wide, and which at every available spot is dammed to furnish power for mills that line its shores from Worcester to Pawtucket so thickly that the water in the pond of one flows back to the wheel of another, is required to carry off the washings of the streets and the sewage from the homes and places of business of a city of nearly 70,000 people. Experts estimate the amount of human excrement alone from that number of people to amount to 65,000 tons annually. The effect of this pollution upon the business and social interests of the town of Millbury, which lies six miles below Worcester on the river, is proving most disastrous. The water in many of our wells has become tainted and unfit for use. The mill ponds are filling up, and the manufacture of woolens is practically driven from our community. From two to four feet of black filth cover the flats and the shores of the river, and in the summer seasons the exhalations from these flats is noisome in the extreme. Night after night this summer our citizens have been compelled to close their windows and doors to shut it out. The State board of health have repeatedly pronounced the river the worst polluted of any in the State. The physicians of the town have unanimously testified that the effect upon the health of the town is injurious. In 1881, and again in 1883, legislation for the relief of the town from the injurious influence of the city was asked. The town at present is attempting to influence public opinion in its behalf. Therefore, uniting with the other citizens and organizations in this effort, the Millbury Grange, No. 107, P. of H., at a meeting held September 11, 1885, adopted the following resolutions: Resolved, that the Patrons of Husbandry of the State of Massachusetts are requested by their fellow Patrons of the town of Millbury to consider the above statement of facts, and by their influence in framing public opinion, and, with the representatives of their several localities, to assist this community in obtaining redress of their wrongs.

ANNUAL REPORT OF THE NEW LONDON, CONN., WATERWORKS.—In accordance with the table suggested by the New England Water-Works Association:

FINANCIAL MAINTENANCE.

Receipts from Consumers.

C.	Net Receipts from Water		$20,077.64
	Receipts from Public.		
F.	Hydrants, 127 at $50	$6,350	
G.	Fountain, 1	100	
H.	Street Watering	800	
I.	Public Buildings, 14	140	
			7,390.00
	*No Income is derived from Public Supplies and these figures are estimated.		
K.	Gross Income from all sources		$27,467.64

Expenditures.

A. A.	Management and Repairs Relaid Service Pipe	$ 4,758.83
B. B.	Interests on Bonds	17,500.00
C. C.	Total Maintenance for Year	$22,258.33
D. D.	Balance to Construction	5,209.31
		$27,467.64

Construction.

R.	Balance from Maintenance	$5,209.31
V.	Total	$5,209.31
W.	Net cost of Works to date	323,442.46
X.	Bonded debt	250,000.00
Z.	Rate of Int., 7 per cent.	
F. F.	Extension of Mains	2,834.68
G. G.	New Service Pipes and Temporary Mains	1,917.00
H. H.	Meters, etc	200.73
I. I.	Total Construction for Year	$4,952.41
J. J.	Balance	256.90
K. K.	Total	5,209.31

Consumption.

1.	Estimated total population at date	11,500
2.	Estimated population on line of pipe at date	10,500
3.	Estimated supplied at date	8,529
4.	*Total number of gallons consumed for the year	360,000,000
7.	Average daily consumption (gallons	993,000
8.	Gallons per day to each inhabitant (1)	86
9.	Gallons per day to each consumer (3)	116
10.	Gallons per day to each tap (distribution 22)	623

*Estimated.

DISTRIBUTION.

Mains.

1. Kind of pipe used—Wrought Iron Cement lined and Cast Iron.
2. Size from 4 inch to 16 inch.
3. Extended 3,523 feet.
4. Discontinued, 0 feet.
5. Total now in use, 24.2 miles.
7. Number of leaks per mile, 2.7.
8. Small distribution pipes, less than 4 inch, total length, 9442 feet.
9. Hydrants added, 4.
10. Number now in use, 127.
11. Stop Gates added, 13.
12. Number now in use, 114.
14. Number of Blow-off gates, 16.
15. Range of pressure on mains at Office for Day and Night, 34 to 53 pounds.

Services.

16. Wrought Iron Cement-lined, Galvanized and Cast Iron.
17. From ¾ inch to 4.
18. ..... 1877 feet.
19. ..... 60 feet.
20. ..... 5.5 miles.
21. Service taps added, 93.
22. Number now in use, 1593.
23. Average length of Service, 18.1.
25. Meters added, 3.
26. Numbers now is use, 29.
27. Motors and Elevators added, 1.
28. Numbers now in use, 8.

NEWS OF THE WEEK.

Contracting.

The "Big" Sewer, Newark.—The cost of the Newark, N. J., intercepting sewer to September 15, was $139,422, of which $131,334 was paid to contractors.

New Tunnel.—Communication is to be kept up between Prince Edward Island and the main land, a distance of four miles, by means of a tube sixteen feet in diameter of chilled anti-corrosive iron, and supplied with air by shafts and duplex pumps.

Austin, Texas Capital.—Mr. Wilke, the sub-contractor of the new capitol at Austin, Texas, has sublet $1,000,000 of material and work on the new capitol, all of which is to be delivered in Austin within one year. The contractors are Northern men.

Mr. Ketchum, Chief Engineer of the Chignecto ship marine railway, was in Ottawa last week on business with the railway and canals department in regard to that scheme, and has submitted plans of the project to the government

The Ohio River Commission will meet in Pittsburgh on the 29th inst., and hear the report of the Ohio river now in the hands of corporations, and will consider the propriety of memorializing Congress to further extend the Chanoine system of dams. The cost of placing such dams at the necessary points between Pittsburgh and Louisville is estimated at $50,000 000.

New Slate Mill.—A new slate-mill is being constructed at Castleton, Vt., by the Bolger Brothers, one of the largest firms in this line in Vermont. This will make the eighth slate-mill in Castleton, and the largest yet built. It will be completed early in February. About seventy-five new hands will be employed then.

Southern R. R.—The South was the only section showing an increase in railroad earnings last year. Reports to the Railroad *Gazette* from eighty-one roads for seven months show Southern roads to be holding their own this year. In earnings per mile Eastern roads have decreased 9.4 per cent.; Southern roads, 1.9 per cent.; Southern roads 0.6 per cent.; Northwestern roads, 3.5 per cent., and Central roads, 4.1 per cent.

Marshall & Northwestern.—The survey of the Marshall and Northwestern railroad reached Winnsboro, Texas on the 15th. The merchants there agreed to pay the company $2,500 as soon as the survey is completed, which is the second installment. The money will be paid to said company promptly.

The New City Hall, Richmond Va.—Messrs. Waite & Cutter, the architects for the new City Hall, are at work on the new detail drawings of the building. They expect to complete that work early in November.

The Canadian Pacific railroad is about to call for tenders for the building of a bridge across the St Lawrence river to connect its system with the American railroads at St. Johns and Southeastern Chambly The length of the bridge will be 3,000 feet and its cos s estimated at $1,500,000.

Grading Machines.—The townships of Benson and Cashel Benson County, Minn., have purchased new graders at a cost of $1,000 each, and already three miles of a magnificent road have been made through low and swampy land within three miles of Benson, where in wet seasons heretofore it has been almost impossible for teams to pass.

Fourteen-foot Bank Lighthouse.—The foundation for the new lighthouse at Fourteen-foot Bank, Delaware Bay, has been completed. The foundation is about 35 feet deep, and reaches the same height above the surface of the water, and is 33 feet in diameter. A light will be exhibited in it this winter. The lighthouse will not be erected until next year. This lighthouse is intended to replace the present lightship which, when ice accumulates, has to be removed.

Troy City Contracts.—The contracting board September 18th awarded the contract for the ironwork for the new bridge over the Wynantskill at the lower factory, to Vanzile, McCormack & Co., for $1390, with $50 extra for floor work. Malone and McKenna were awarded the contract for the masonry as follows: Limestone work $15.40 per cubic yard; local stone $6.90; new paving $2.75 per square yard; relaying old pavement 25 cents per yard; resetting curb 12 cents per foot, cesspool $100.

Contracts Awarded.—Thomas Shannahan has been awarded the contract to build the retaining will on the Western Promenade, Portland, Me.

John J. Shipman, of Newport, Ky., has been awarded the contract to build the extra ice pier in Kanawha at $20 a thousand for timber and 90 cents a yard for stone.

There have about a dozen bidders on the contract for building the Reuben Hoar library at Littleton, Mass., and they ranged in price from $8,000 to $13,000. It is understood that S. F. French of Lowell will get the contract, and that work will be commenced about Oct. 1. This is the institution that William S. Houghton of Boston, a native of Littleton, gives $10,000 to found, provided the town appropriates a certain sum, which it has voted to do.

R. R. Ties.—A large suply of Georgia pine railroad are now being received by the Delaware and Hudson canal company and the New York Central and Hudson river railroad company. The cost of the ties is $450 per 1,000.

The Brooklyn Garbage Contract.—Commissioner Fleeman, on the 12th, opened the following proposals for removing the Brooklyn garbage for one, two, three, four and five years.

Robert Furey, $15,500 each year; Daniel Gallagher, $34,000 a year; Edward N. Lynch, $46,000 a year, or for five years, $227,000; Felix Hickey, $49,300 a year; Nassau Sanitary Company, $75,000 a year; Frederick Krikeler, $37,000 a year, for full term, $295,000; John H. O'Rourke, $65,000 a year; John Briggs, for two years, $37,500, and for the succeeding three years, $62,500; Henry Beran, $65,000 a year, or $97,500 for eighteen months, and for full term, $400,000; Peter Blake, for two years, $140,000, and the next three years, $240,000; Henry Hamilton, for two years, $120,000, and for the succeeding three years, $210,000; Thomas F. White, $81,000 a year; George F. Swift, $46,300 a year, and 10 per cent. reduction for each year after the first year.

Mr. Furey says he made a mistake of $60,000, and does not want the contract at his bid.

Mississippi Reservoirs.—The government engineers' report concerning the reservoir system at the head waters of the Mississippi gives the result of experiments made in the last six or seven weeks. The upper reservoirs, 500 miles above St. Paul, were opened on August 1, and the receiving reservoirs, 400 miles above St. Paul, two weeks later. On September 1 the surface of the stream at points from 250 to 300 miles below the receiving reservoir, was two feet higher than it would have been if the gates had not been opened. At St. Paul there was about one foot of reservoir water. It is expected that, when the full effect of the system shall appear, about four feet will be gained at a point 100 miles above St. Paul, and from one to one and one half feet at St. Paul. The three reservoirs already completed, have a capacity ranging between 6,000,000 and 7,000,000 cubic feet of water, a fourth will be added this autumn. The water-power at several points will be improved, as well as navigation.

Albany, N. Y. Paving.—The following bids were opened by the Board of Contract and Apportionment September 21st.

EAGLE STREET PAVEMENT.

	Paving per yard.	New curb per foot.	Allowance for cob st.	Allowance for old curb.
Ed. J. McKeever, Brooklyn	$2.35	$0.75	$0.01½	$0.01
Anthony M. Brady	2.31	.80	0.6	.06
John J. Holler	2.53	.70	0.3	.05
Patrick McQuade	2.57	.80	0.4	.05

The contract was awarded to A. N. Brady. The aggregate amount of the bid was $38,613.46.

WASHINGTON AVENUE PAVEMENT.

	Paving per yard.	New curb per foot.	Dressing per foot.	Allowance for cobbles.	Allowance for old curb.
Edward J. McKeever, Brooklyn	$2.37	$0.75	$0.07	$0.01½	$0.01
A. N. Brady	2.34	.80	.20	.06	.06
John J. Holler	2.37	.73	.15	.05	.05
Patrick McQuade	2.62	.83	.15	.05	.06

The contract was awarded to A. N. Brady. The aggregate amount of his bid was $68,693.38, being $1,340 lower than McKeever.

MYRTLE AVENUE DRAIN.

	per lin. yd.
John McElrone	$0.69¾
John Doyle	.85
Patrick McQuade	.65

The contract was awarded to Patrick McQuade.

MORRIS STREET EXCAVATION.

	Ex'tg cub. yd.	Filling cub. yd
Patrick Reilly	$0.19¾	$0.05
George Holler	.16	.05

The contract was awarded to George Holler.

In the matter of the Clinton avenue apportionment, the clerk was instructed to modify the same, and as modified to publish it for objections. The board resolved to visit the State street sewer and view the property benefitted preparatory to making the apportionment for the expense of the work. The new pavements are to be laid by December 1st.

Holyoke Dam.—The work of improving and strengthening the "big dam," at Holyoke, Mass., goes quietly and steadily on, and the company have 135 men, including three experienced divers, employed on the work, and they are skilled artisans for the most part. They work all day and until 8 o'clock each night, the electric lights being used after dark, while one day during the week they work all night. Of the 1,017 feet of woodwork and filling to be done, 509 are finished; 261 feet are now being gone over, leaving a section of 247 yet to be repaired. The amount of gravel used daily on the works is about 400 large buckets, and this is thoroughly puddled in the many bins of which the dam is composed.

Levee Contracts.—The following awards were made at the meeting of the Mississippi Levee Board on the 15th.

Robertsonville Levee, 65,000 yards to D. H. Hartnett, St. Louis, at 16 c.

New Hope Protection Levee, 25,000 yards to John B. Reid, Vicksburg, at 15¾ c.

Concordia to Victoria, enlargement, 80,000 yards, to Harvey & Scott, Memphis, @ 19¼ c.

Kentucky Enlargement, 12,000 yards, to Geo. Arnold & Co., Memphis, @ 16¾ c.

Franklin Hoop Enlargement, 10,000 yards to Delyaris & Arnold, Memphis, @ 15¾ c.

Connelly Hoop, 20,000 yards to Davis & Winter, of Greenville, Miss., @ 13¾ c.

Chootaw Bend Enlargement, 10,000 yards to R. H Parnell & Co., Rosedale, Miss., @ 19 c.

Deerfield & Harford Enlargement, 7,500 yards, to Geo. Arnold & Co., Memphis, @ 21¾ c.

Elwood & Valewood Enlargement, 17,000 yards to J. F. Duffin Bro., Memphis, @ 16¾ c.

Homochitto and Holly Ridge Enlargement, 5,000 yards to Geo. Arnold & Co., Memphis, @ 20 c.

Duvall, Burleigh & Ingoman Enlargement, 10,000 yards to J. A. Carman, Greenville, Miss., @ 15 c.

Chotard Enlargement, 30,000 yards to J. A. Carman, Greenville, Miss., @ 15 c.

Brunswick Levee, 120,000 yards to Harvey & Scott, Memphis, @ 15¾ c.

Eagle Lake Extension, 40,000 yards to John B. Reid, Vicksburg, @ 14¾ c.

Embankment measurement; bidders very numerous and respectable; bidding spirited; prices regarded as very low—much of the work being "enlargement" of old embankments.

William Starling is Chief Engineer, and headquarters are at Greenville, Miss.

Bids Opened at Dayton, O.—Proposals were received on the 17, for material and labor for the construction of the new Library building, Dayton, O.

All cut stone work, including labor and materials:

L. Sutter & Son, all limestone work; labor, $4,580; materials, $2,600; total $7,180.

All sandstone work; labor, $11,785; materials, $12,745; total, $23,530. Quarries, Marquette, Michigan, red.

Conrad Herman, all limestone work; labor, $5,231; materials, $3,400; both combined, $8,462.

All sandstone work; labor, $11,000; materials, $11,000; both combined, $21,886. Quarries, Marquette, red.

A. Dale, Jr., all limestone work; labor, $5,000; materials, $2,520; total, $7,520.

All sandstone work; labor, $12,000; materials, $9,887; total, 21,836.

Quarries, Marquette.

All brick work; labor, $3,000; materials, $1,430; total, $5,430.

John W. Boren, all brick work; labor, $2,500; materials, $3,500; total $5,460.

L. H. Webber, all limestone work; labor, $6,000; materials, $2,000; total, $10,000.

All sandstone work; labor, $9,500; materials, $12,000; total, $21,500.

Quarries, Marquette, red.

All sandstone work; labor, $13,200; materials, $11,000; total, $24,200; quarries, Kibbi and Norcross.

All sandstone work; labor, $12,600; materials, $9,000; total, $21,600; quarries, Norcross and Long Meadow.

Stephen Kemp, all brickwork, labor, $2,500; materials, $5,2400 total, $7,740.

H. B & J. W. Sortman, all brickwork, labor, $2,300; materials, $4,000; total $6,300.

All bids referred to the Committee on Building.

Railroads, Bridges and Canals.

New R. R. in Vermont.—There is talk of building a railroad from East Montpelier to Barre, Vt.

R. R. Ties.—Two Deadwood, Dak., contractors have agreed to furnish 125,000 ties at 38 cents apiece.

The Milwaukee & St. Paul will, it is said, build a line from Fountain to Chatfield, Minn.

Norfolk & Western R. R.—This Co., will change the gauge of its track on May 1st, next.

A New R. R. for Illinois.—A railroad is proposed from Carbondale to Paducah, via Metropolis, with a probable extension to St. Louis, Mo.

The Canadian Pacific.—It is announced that the Canadian Pacific Railway will be opened for the carriage of freight and passengers to British Columbia, on the 5th. prox.

Coney Valley Line R. R.—Chautauqua Co., Kansas has voted $72,000 in aid of the above line; Wilson Co., has voted $52,000.

The Missouri Pacific Company has begun the work of constructing a line from Nevada, Mo., through Pittsburg and Columbus to Chetopka, Kan., 70 miles.

Car Contract.—The Gilbert Car Company of Troy, N. Y., is building four handsome sleeping cars for Australia.

Mt. Royal R. R.—This new line to the summit of the Montreal mountain, 510 feet high, and costing $22,000 for construction and equipment, was opened on the 12th.

Street Railroad.—The Metallic Street Railway Company of Albany, has been awarded the contract for the Albany and Greenbush R. R. The road will be entirely of iron.

The Fort Worth and Denver Railway Company is negotiating for the rights and franchises of the Fort Worth and Rio Grande railway, with a view of building a road from Fort Worth, Tex., to Brownwood.

New Bridge.—A new iron bridge over the W. & W. R. R. on Fourth street, Wilmington, N. C., is proposed. The plan proposes 46 feet of driveway, and 20 feet footway. Cost of superstructure estimated at $3,860.

The New Split Switch of the Missouri Pacific standard pattern is being put in everywhere on the main line of the W., St. L. & B. railway as fast as they can be procured. They possess many merits over the old style switch.

The Rock Island Railway company is coming to the front with freight-train improvements. It has recently equipped 400 freight cars with air brakes for use on fast through freight trains. The schedule time will be 25 miles per hour.

Grand Rapids & Saginaw R. R.—An attempt to revive an interest in this project, and secure funds for its construction was made at Grand Rapids, on the 15th. A meeting was held, subscriptions pledged, and a committee to further canvass for money appointed.

Car Contracts.—The Missouri Car and Foundry Company, in St. Louis, has a contract to build 600 freight cars for the Missouri Pacific road. The Barney & Smith Manufacturing Company, Dayton, O., is to build twenty-four passenger and 1,000 freight cars for the Wisconsin Central road.

Prescott & Arizona Central.—Grading is in progress on the Prescott & Arizona Central, a line extending from Chino Station, Arizona, on the Atlantic & Pacific road, southward toward Prescott, seventy miles, and twenty-five miles are ready for ties and iron. Chino is 431 miles west of Albuquerque, New Mexico.

Mexican Central R. R.—D. MacKenzie, General Superintendent; R. E. Briggs, Chief Engineer; H. C. Barlow, Traffic Manager; F. W. Johnstone, Superintendent of Machinery have been continued in their respective offices till further notice, by the new General Manager, Edward W. Jackson.

A Great Draw Bridge.—At exactly fifteen minutes to 5 o'clock, September 15th., the great draw (the largest in the world) of the Minnesota and Northwestern's bridge across the Mississippi river at St. Paul, was moved for the first time since it was set in position. It worked to a charm.

Chili R. R. Debt.—Chili now owes on account of her railways $24,870,000. In 1883 these railways earned a revenue of $6,516 040, on a capital of originally less than $60,000,000, and which is now reduced to $22,450,000. The railways of the Argentine Republic are on the average earning an annual divident of 6½ per cent.

Cost of a Freight Car.—Master car builder George Petty, of the C. W. & M., kept an accurate account of the cost of material and labor required in the construction of a combination car now in service on the line, and reports the outlay at $2,200. At any car works the same car could not have been bought for less than $3,000.

Suspended Operations.—The engineers and contractors of the Chicago, Burlington and Northern Company have suspended all operations between Galena, Ill., and the mouth of the Galena River, pending the injunction served against them by the Chicago and Northwestern Company, who set claim to the ground in Galena on which the former commenced to lay their track. A motion to dissolve the injunction was argued on the 17th. inst. before Judge Eustic at Freeport.

The Chicago, Milwaukee, and St. Paul engineering party charged with the survey of the line from Kansas City to a connection with the St. Paul, took the field September 12th., beginning operations at the Missouri River. There are three surveying parties in the field, and another will be put on shortly. The engineer in charge states that it will be some time before any grading is done, as he intends to make a thorough survey, and take plenty of time to complete the locations and all of the plans before the contractor will be allowed to move a shovel.

Manitoba and N. W.—Track laying is progressing at the rate of a mile and a half per day.

Midland R. R.—Prisco and Fiorcella, contractors for the above line between Noblesville and Lebanon, Md., have already graded 6 miles of track, and propose to complete the work by Oct. 1st, ensuing. Headquarters at Noblesville, Md.

The Clarendon and Pittsford Railroad Company has incorporated at Montpelier, Vt. The road will be about 12 miles long. The capital stock is $130,000 and the incorporators are Redfield Proctor of Rutland, E. J. Ormsbee of Brandon, J. W. Hobart of St. Albans and D. K. Hall and F. D. Proctor of Rutland. It is projected with reference to the marble business.

Port Huron Tunnel.—The Grand Trunk is making fine progress in its experiments for the construction of a tunnel under the river at Port Huron. Nine test-holes have already been sunk, with the most satisfactory results. Four more will be put down, and if these prove as satisfactory as the others, the work of construction on the new tunnel is to be commenced at once.

The Pocahontas and Hoxie R. Co., has been incorporated at Little Rock, Arkansas. The capital stock is $66,000. The road is to commence at Pocahontas, in Randolph County, and run to Hoxie, on the iron Mountain and Kansas City and Memphis Railroads, a distance of fourteen miles. The stockholders are residents of Pocahontas.

Delaware & Hudson Canal Co.—This company is building a two mile branch from its main line north of Albany, N. Y., to Breaker Island, in the Hudson, where three new blast furnaces are being erected for the newly organized Troy & Rensslaer Steel and Iron Co., in which the D. & H. Co. is a large stockholder. This branch will be extended to Island Park where a station will be erected. The company is also doing considerable bridge work along its line.

N. Y. C. & H. R. R. R.—The N. Y. Central is putting down an extra double track on the west side of its main line for a short distance south from Hudson; the fill is made as far as the bridge and gangs are now laying the ties and rails. At Fishkill, just south of the depot, a trestle Y is being built from the main track to the freight yards. New rails weighing 72 pounds per yard have been laid between Troy and Albany, and will probably be introduced gradually over the whole length of the line.

North Carolina R. R.—The people of Cleveland County, N. C., have voted a subscription of $125,000 to aid in the continuation of the railroad from Shelby to Rutherfordton, and also another line from Shelby through Burke County to the iron mines at Cranberry, in Mitchell County. It is also intended to connect Shelby with King's Mountain, N. C., and Yorkville and Charleston, S. C., in one direction, and with Cincinnati and intermediate points in another direction. The eastern route is to be built by the Massachusetts and Southern Construction Company.

R. R. Building in California.—Superintendent Fillmore, of the Southern Pacific Company, states that work will be commenced immediately on the extension of the California and Oregon road. From eight hundred to one thousand men will be placed on the line north of Redding and kept there until spring, occupied chiefly in tunneling and excavating and otherwise preparing for the grading, which latter work will commence as soon as the rains are over. The Superintendent states that they will not likely reach the State line inside of a year.

City of Mexico and Tuxpan Road.—The circular issued in London in August, calling for subscriptions to the City of Mexico and Tuxpan railroad, and stating that 70 miles of the road was built, was evidently designed to entrap innocent money-lenders. No route has ever been surveyed, and the endeavor to raise money was the first intimation of the enterprise of the company conducting the City of Mexico and Tuxpan Railway company (limited) in Mexico. The company is backed by some well-known speculators, and is thought to have secured considerable money in England and in New York. The Mexican papers mention several similar schemes which have their origin in London and New York, and advise hasty capitalists to beware.—*Galveston News.*

Relocating the Midlands Railroad.—The engineer corps engaged in the relocation of the Philadelphia and Midlands Railroad have nearly completed their labors. The new line from Newtown Square, Delaware County, to West Chester follows very closely to the West Chester pike. The work on the new location will be slightly heavier than on the old, but the distance is thereby shortened one mile. A committee of the directors are now negotiating for terminal facilities and have three plans under consideration. A meeting of the Directors will be held in the near future, at which time this matter will be determined on. The company hope to begin the work of construction very soon. Eventually the road will probably be extended to York or Lancaster, and thus tap a strip of country as yet without adequate railroad facilities.—*Lancaster New Era*

Alpena, Michigan, Bridge—The Common Council of Alpena, Mich., has decided to build an iron bridge to take the place of the one now over Thunder Bay River between Second and Dock streets. The bridge is to cost $10,000 and is to be 172 feet long; roadway to be eighteen feet in the clear and two walks, each five feet in the clear. The bridge is to be ten feet above high water mark. The work is to be done this winter. A special meeting was to be held on Thursday, September 24, 1885, to see if the citizens will allow the city to be bonded to the amount of $10,000 for building said bridge.

A $3,300,000 Foreclosure.—MUNCIE, IND., Sept. 19. Suit was begun to-day in the Delaware Circuit Court, by the Central Trust Company of New York, against the Lake Erie and Western Railway to forclose mortgages aggregating $3,800,000. The mortgages were given in 1879. A consolidation of the Lake Erie and Western and Lafayette, Bloomington and Muncie Railways, was made to secure the payment of 3,300 bonds, of $1,000 each, falling due in 1919. The interest is due and unpaid on the first bonds, and large amounts are being borrowed, and the property depreciating. There are also judgments against the road for $2,000,000 received by George J. McGourkey. Hence the suit. J. McGourkey and J. P. Cheney are made parties to the suit as well as the company. A new receiver is asked for, and an injunction restraining interference or the transfer of mortgaged property pending the trial.

The Windsor Locks and Warehouse Point, bridge company has been organized by the election of these nine trustees: J. H. Simmonds, J. R. Goldson, Emory Bancroft, of Warehouse Point, J. T. Coogan of Windsor Locks, B. M. Douglass of Windsor Locks, George Douglass of Suffield, J. H. Alderman of Suffield, Richard D. Case of Windsor, L. A. Upson of Thompsonville. J. H. Simonds is president and treasurer, and S. B. Douglass secretary. The capital stock of the company is $40,000. The bridge and the ferry franchise will cost about $85,000 and bonds are to be issued for $45,000. Contractor Roebling, who built the Brooklyn bridge, has taken the work at $55,000 for the bridge complete, except the filling in on the east side of the river. The stone-work was sub-leased to Robert Dorsey of Florence, Mass., for $16,000. Col. E. N. Phelps of Windsor has been appointed by the company inspector of building the piers and anchors. The stone used is from the Portland and East Windsor quarries. The piers are to be 35 feet high and the towers 70 feet high. On the east side piles had to be driven, in some cases 20 feet deep. On the west side the pier rests on a solid ledge of rock. It is expected that the piers will be completed in about three weeks and that the bridge will be ready for travel about the first of January. The roadway of the bridge is to be 20 feet.

Northern & Western (N. B.) Railway.—This road or as it is sometimes called the Miramichi Valley Railway is rapidly approaching completion.

This road promises to play an important part in contributing to the material prosperity of New Brunswick and will shorten the distance by rail more than one hundred miles between New England and the Miramichi Bay, which is rapidly becoming an important maritime port.

The Northern & Western Company was organized in 1872, and a charter secured. Alexander Gibson, of Marysville and J. B. Snowball of Chatham are the prime movers in the enterprise, and it is their capital and energy that is putting the project through. Alex. Gibson is President, J. B. Snowball, general manager of the Northern end, and H. A. Hancox, chief engineer.

A subsidy of $3,000, per mile was granted by the provincial government, and $3,200 per mile for the first forty miles of the southwestern end by the general government, which has recently granted an additional subsidy for forty-six miles more.

The terminus of the road is at Gibson, opposite the City of Fredericton, on the St. John River, and at Chatham Junction on the Intercolonial Railway.

Total length 107 miles; maximum grade 66 feet per mile maximum curves, 955.6 radius; 56 pound steel rail. There are over 2500 feet of wooden bridges to be built, the largest of which are as follows:

Nashwaak River 300 feet Howe Truss.
Penniac 40 feet, Cross Creek 80 feet.
Burnt Land Brook 440 feet.
Nelson's Hollow 40 feet.
Miramichi River, at Doaktown, 470 feet Howe Truss; at Blackville 335 feet Howe Truss; Barnaby River 335 feet, Howe Truss.

Contract was let to Messrs. Reul & Clendennon by the mile. Construction began in 1884, and has continued without interruption up to the present time.

Forty miles have been completed on the south-western end, and twenty miles on the north-eastern up to date. Twenty miles more are graded ready for the track, and nearly 800 men are now at work on the grading which is being pushed as rapidly as the physical difficulties of the country will admit. Gibson, Marysville, Boistown, Doaktown and Blackville are the principal towns the road passes through.

The Company has already purchased six locomotives, 1 passenger car, 24 flats, 8 box and 3 combination. They have built two pretty depots, and have another under way, and a five stall brick round-house at Gibson.

New Georgia R. R.—A number of capitalists signed a contract last week, to grade the road from Elberton, Ga., to Enright's store, in Abbeville county. Col. James Edward Calhoun has signed the right of way, 100 feet wide, through his lands in Georgia and South Carolina and is contemplating the construction of the bridge across Savannah river at his own expense—he having all the granite and timber on his own place which may be necessary to build it.

The Topeka Hiawatha and Chicago Railway was incorporated on the 18th. The route of the new line is from Topeka, Kan., to Hiawatha and to a connection with the St. Joseph and Denver and Missouri Pacific, sixty miles in length; thence to Rulo, Neb., where it connects with the Burlington system, fifteen miles more. The officers of the company are: Thomas A. Osborne, President; John Francis, Treasurer; D. Wilder, Secretary; J. K. Hudson, F. P. Baker and M. M. Beck, of Jackson County, are members of the directory.

A Private Enterprise.—Messrs. Sibley and Pearringer, two wealthy owners of pine lands on the Pine, Popple, Peshtigo and Armstrong rivers in Florence county, Wis., has under contemplation the construction of a railroad line, eighteen miles in length, from a point six miles south of Hulbert Lake to a junction with the Milwaukee & Northern, near the present terminus of that road. One of these gentlemen lives at Rochester, N. Y., and the other in Michigan, and together they own about 200,000,000 feet of pine timber.

A Cavern Under a Railroad.—On the New York, West Shore and Buffalo Railroad, just east of Glen Erie, N. Y., on the 17th, upward of 700 feet of an embankment, thirty feet high, suddenly sank, taking down both railway tracks. A temporary road bed was marked out around the hole, and in twenty-six hours a track was in readiness for trains. All sorts of conjectures have been made as to the cause of the sinking, the most tenable one being the existence of a subterranean cavern.

The Missouri Pacific in Kansas charter was filed on the 17th, with a capital stock of $3 000,000. The directors names are: Jay Gould, of New York, H. M. Hoxie and D. S. S. Smith, of St. Louis, W. W. Fagan and A. D. Everest of Atchinson, C. E. Faulkner and A. M. Claflin, of Salina, S. G. P. Bryant of Lincoln, J. C. Woods, of Stockton, and Volney Ball of Colorado. The Missouri Pacific has purchased the franchise of what is known as the Topeka, Salina & Western Railroad, a part of that which has been graded and tracked. The scheme is to complete this line, and makes a connection with the Missouri Pacific at Ottowa, and extend the new road from Salina northwesterly to an intersection with the Central Branch road, and thence to Denver, making a through route from Kansas to St. Louis. Five hundred men were sent West to-day to begin the work. The line is to be finished to Salina by December 1.

Canadian Pacific R. R.—The rumors which were in circulation some weeks ago to the effect that serious frauds had been discovered in measurements of several of the contracts on the section north of Lake Superior on the Canadian Pacific Railway were to-day confirmed, the engineers who were deputed to remeasure the work having completed their labors and proved to the authorities of the road beyond the shadow of doubt that many of the contractors have been overpaid to the extent of several hundreds of thousands of dollars. It is said on reliable authority that criminal and civil proceedings will be instituted against some of the contractors and engineers, alleging conspiracy. The officials were not prepared to speak on the matter. From well-informed sources, however, it is learned that the amount involved will aggregate $500,000; that one contractor has been paid over $100,000 in excess of proper measurements. Leading counsel have been retained to defend the contractors, who, of course, give a very different shade to the story and say that the company is attempting to bulldoze the contractors, who have, during its financial embarrassments, been carrying on the work with their own capital.

Northern Pacific R. R.—Respecting the completion of the Cascade Branch, about which there is a decided difference of opinion among parties interested in the road, the report states that twenty-five miles are under construction on the west side of the Cascade Mountains, and forty miles on the east side, the cost of which will be $1,840,000. To complete the Cascade branch, there will remain seventy-five and a half miles, not including the sixty-five miles under way. The estimated cost of the seventy-five and a half miles is as follows: Fifteen and a half miles over the mountain, including the tunnel nearly two miles long, $2,441,200; the approaches on each side, $1,430,700; making a total of $3,871,900, to which is added for snowsheds, if needed, $200,000, making a grand total of a little over $400,000. The total estimated cost of the 140 miles required to complete the gap is $5,911,900, and the amount of first mortgage bonds that will be available for the work is $3,512,000, leaving to be provided from other sources $2,399,400. The report says that it will require between two and a half years to construct the tunnel with economy. The total amount expended for construction and equipment during the past year was $3,562,030.

New Trans-Continental.—Less than twenty miles remain to complete the gap between the California Southern and Atlantic & Pacific Railroads.

The Wichita, Great Bend and Colorado Railroad Company has been formed for the purpose of constructing a line starting at Wichita, Kan., and running through the counties of Sedgwick, Reno, Stafford, Barton, Rush, Ness, Lane, Scott, Wichita and Greeley, in the State of Kansas, to the west line of the State. Capital stock, $2,000,000; place of business, Great Bend. Directors—Charles F. Culver, John V. Brinkman, Edward R. Moore and Cæsar Samuels, of Great Bend, and A. Warder, of Reno County.

Tunnel Progress on the South Penna. R. R. to Sept. 1st.—The following official report of tunnel progress on the South Pennsylvania Railroad, is of interest in connection with the proposed stoppage of work and amount of tunnel excavation actually done to within a late date:

TUNNEL PROGRESS FOR WEEK ENDING AUG. 29th, 1885.

Name.	Length.	Heading. W. End. Prog.	Heading. W. End. Total.	Heading. E. End. Prog.	Heading. E. End. Total.	Bottom. W. End. Prog.	Bottom. W. End. Total.	Bottom. E. End. Prog.	Bottom. E. End. Total.	Length Remaining to be done.	Class of Material. West end given first
Blue Mt	4240	—	1188	16	1836	—	1168	18	1793	1216	Red Sand Stone.
Kittatinny	4620	—	1675	42	2278	—	1632	35	2165	667	Olive Shale
Tuscarora	5225	34	1754	11	1876	20	1695	16	1834	1595	Lime Shale. Red Sand Stone.
Sideling Hill	6662	—	1677	—	1662	—	1562	5	1654	5396	Grey Sand Stone.
Rays Hill	3834	15	1110	87	1254	16	1064	12	1286	1138	Coal & Black Sl.
Allegheny Mt.	6919	—	1913	—	2093	—	1780	—	1721	1973	Soft Black Slate.
Negro Mt	1160	—	45	—	636	—	—	17	502	419	Soft Grey Stone.
Quemahoning	700	—	339	—	73	6	261	—	—	288	" "
Laurel Hill	5369	—	869	—	396	—	648	—	110	4104	
	37389									Length remaining 14796	
										Length excavated 22593 = 60.4 %	
										Total Length 37389	

N. Y. P. & O. R. R.—The papers reached the court on the 18th in a new suit by McHenry and his friends. In it the Commonwealth is made co-plaintiff, and a writ of quo warranto is asked for to have President Adams and the directors show by what right they hold their offices. It appears in the papers of the case that Prince Czartoryski, who is a co-plaintiff with McHenry owns $300,000 of bonds of the company, which he inherited from his mother, Queen Christina of Spain. She was a widow when she married Prince Czartoryski and had an immense fortune. McHenry met her and persuaded her to give him $1,000,000 to build the road.

Index to Periodical Literature.

Cement.—(See Portland Cement).

Electric Light.—*Magneto-Electric Machines and the Voltaic Arc for Lighthouses.*—An exhaustive paper by M. Felix Lucas. The first electric lighthouse was on the French coast in 1863. Different machines are described and compared. The theory, is discussed, and the cables and other practical matters described. Notes are made on the cost. Numerous tables and formulæ are given. *Annales des Ponts et Chaussées.* July 1885, pp. 47 to 121.

Excavator.—*Dunbar and Ruston's Steam Navvy.* A strong iron frame mounted on wheels has the engine and boiler at the rear, and an iron tower at the front; this tower carries the top pivot of a triangular, braced jib, from which is hung a timber arm at the end of which is the bucket. The engine has two inverted cylinders and a vertical boiler, it is 10 N H. P. Fully described and illustrated. *Engineering.* August 21, 1885. pp. 178, 180.

Gas-Engine.—*Atkinson's Differential Gas-engine.* The object of the design of this engine is to allow the gases to expand more rapidly and be in contact with the cold walls for a less time than in other engines. The cylinder is open at each end and has two pistons, which are connected to one crank-pin by double-ended levers, and very short connecting rods from which the differential motion is obtained. The operation is described. Illustrated *Engineering.* August 21, 1885, pp. 187, 188.

Locomotives.—*The History of Compound Locomotives.* A brief history of the progress of these engines. First experimented with in 1850 in England, and gradually introduced into France, Germany and Austria. The dimensions are given of an English compound tank engine, with notes of its working. *Railroad Gazette,* August 28, 1885, p. 553.

Portland Cement.—*Testing Portland Cement.* Describes the operations for testing for different qualities, and insists on the advantage of fine grinding. Points out the inefficiency of a seven days test. Suggests that a committee of engineers, architects, contractors and others be appointed to investigate the subject. Tables and diagrams of value and comparisons of specifications are given. *Engineering,* Aug. 14, 1885, pp. 145, 146.

Railroad.—*The Construction of a Railroad in a Submersible Valley.* The Orleans R. R. (France) between La Flèche and Saumur crosses the old bed of the Loire, which is sometimes submerged by the breaking of the levee. The roadbed has a transverse slope of about 1 in 39 to facilitate the draining of the track after submersion; the slope of the bank is protected by stone pitching with a masonry coping, and ditches are made at the foot on each side. Culverts are made at intervals of 33 feet. A profile and drawing of the works are given. *Le Génie Civil* August 15, 1885, p. 249.

River Pollution.—*Effect of the Drought of 1884 upon the Pollution of the Thames below London.*—R. W. P. Birch, M. I. C. E. During the drought the river was very foul, and it was desired to ascertain to what extent the sea-water acted to mitigate the nuisance while the dilution with fresh water was at a minimum. It was found that the quantity of sea-water was greater, but that its effect was greatly reduced by its slow circulation. Tables and diagrams are given. *Min. Proc Inst. C. E.* Session 1884-85. Vol. lxxxi, part 3.

Vapor Engines.—*The Efficiency of Fluids in Vapor Engines.*—A theoretical consideration of the subject, which is fully dealt with. The following liquids are selected for comparison,—water, alcohol, ether, bisulphide of carbon, and chloroform. The subject is worked out by formulæ, and several tables and diagrams are given. By H. L. Gantt and D. H. Maury. *Van Nostrands Engineering Magazine,* 1884.

Water Supply.—*Pumping Machinery versus Reservoir.*—Read before the Engineers Club of Minnesota, April, 1885. Points out the advantages possessed by machinery over reservoirs, where the water is elevated by artificial means, and there is an inexhaustible supply. The subject is considered with reference to reserve in case of accident; power to increase pressure when necessary; economy in first cost; and quality of water delivered. *Journal of the Assoc. of Eng. Societies.* August, 1885, p. p. 368 to 374.

Market Report of Engineering Materials.

New York, September 24, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.			
Angles	1.9c.	@	2.2c.
Tee	2.3	@	2.4c.
Beams and channels American	3.0c.	@	
Tank	2.	@	2.1c
Shell	2.4c.	@	2.5c
Steel plates, Tank	2¾c.	@	3c.
WROUGHT-IRON PIPE.. PITTSBURGH.			
Butt welded, black.....Discount	42½	@	45
" galvanized..... "	35		
Lap welded black..... "	60	@	62½
" Galvanized..... "	45		
Boiler tubes..... "	57½		
RAILS.			
Steel (large lots at mill)	29.00	@	30.00
Old rails	17.00	@	17.50
Old rails steel	17.00	@	18.00
R R. spikes	1.8	@	1.9
R R. splice-plates	1.65	@	1.7.
R R. Track Bolts Square Nuts	2.55	@	2.65
Barb-wire fencing, galvanized			4.50
" " painted			3.50
Corrugated iron			
Nails			
Iron	2.35		
Steel	2.50.	@	2.60

METALS.

COPPER.			
Lake Superior	11	@	11¼
Other Brands	10¾	@	11¼
LEAD.			
Com. Domestic	4.25		
Lead Pipe	.06¾		
Tin-Lined Lead Pipe	.15		
Sheet Lead	.06¾		
ZINC.			
Sheet	5.65	@	5.87

BRICK.

(Cargoes afloat)			
Haverstraw.....per M.	$5.75	@	6.00
Fishkill			
Up-River	5.25	@	6.75
Jerseys	4.62	@	5.50
Long Island			
" pale	2.75	@	3.00
FRONTS.			
Croton red	11.00	@	14.00
" dark	11.00	@	14.00
" brown	10.00	@	13.00
Philadelphia pressed	24.00	@	25.00
Trenton "	24.00	@	25.00
Baltimore "	37.00	@	41.00
Buff "	33.00	@	35.00
Enameled English	65.00	@	130.00
" American	85.00	@	120.00
Fire brick	25.00	@	40.00

CEMENT.

PORTLAND.			
Gibb's English 400 lbs. per bbl	2.75	@	2.90
K. B. & S. " "	2.85	@	3.00
J. B. White & Bros., Portland Cement	2.65	@	3.00
do Keene's Superfine,	8.00	@	10.00
do " Coarse,	5.00	@	6.00
Roman	2.75	@	3.50
Largerdorfer German "	2.55	@	2.80
Dyckerhoff, " "	2.90	@	3.25
Stettiner " "	2.60	@	2.65
Hanover " "	2.60	@	2.65
Vorwohler, Lion "	2.90	@	3.25
Alsen, " "	2.55	@	2.60
Fleve "	2.40	@	2.50
Saylor's American	2.15	@	2.40
Windsor } U. S. C. Co.	1.00	@	1.10
Standard } U. S. C. Co.			1.15
Cable's Portland } F. O. Norton	2.15	@	2.40
F. O. Norton			1.10
ROSENDALE cements	.90	@	1.00

LIME.

Rockland common per bbl	1.00		
" finishing	1.20		
State, common	.90		
" finishing	1.10		
Kingston, ground	0.95		
Add 25c. to above figures for yard rates.			

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90	@	95
" " No. 2 "	0.75	@	0.80
" " light drab "	0.80	@	0.95
Berlin " in rough "	0.75	@	1.00
Berea " " "	0.75	@	1.00
Brownstone, Portland, Ct. "	1.00	@	1.30
" Belleville, N. J. "	0.75	@	1.25
Granite, rough	0.60	@	1.25
Common building stone per load	2.00	@	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40	@	3.00

SLATE.

Purple roofing per square	6.00	@	7.00
Green "	6.00	@	7.00
Red "	15.00		
Black Penna. (at New York) "	4.50	@	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00	@	20.0
" Choice "	55.00	@	80.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44	@	.50
Tally boards, dressed com. "	.28	@	.30
SPRUCE, Boards dressed "	.25	@	.28
Plank, 1¼ in "	.28	@	.30
" 2 in. "	.38	@	.40
" 2 in. dressed "	.43	@	.45
Timber per M.	20.00	@	22.00
HEMLOCK, Boards each.	.18	@	.20
Joist, 2½ × 4 to 4 × 6 in	.17	@	.44
OAK per M.	55.00	@	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00	@	40.00
YELLOW PINE, Girders "	25.00	@	30.00
Dressed flooring "	28.00	@	35.00
SHINGLES, Extra shaved pine, 16in. "			
" sawed 18 in. "	5.75	@	6.00
LATH, Cargo rate "	2.10	@	2.25

PAINT.

Lead, white, American dry per lb	.04¾	@	.05
" in oil pure "	.05¾	@	.05¾
English, B. B. in oil	.08¾	@	.08¾
Red, American	.05½	@	.05¾
Litharge "	.05	@	.05¾
Venetian red, American "	.01	@	.01¾
Indian red "	.05	@	.10
Vermillion, American lead "	.11	@	.11¾
Paris green "	.15	@	.19
Umber, Amer. raw and powdered per lb.	.01¾	@	.01¾
Drop black, Amer. "	.08	@	.12
" " "	.09	@	.11¾
Chrome green	.05	@	.15
Oxide zinc, American	.03¾	@	.04
" French	.06¾	@	.06¾

Florida R. R.—The survey of the Lake Shore road from Kissimmee City to Apopka city was completed last week. Chief Engineer J. P. Little is now working on the profiles, preparatory to the construction of the road at an early date. Capt. W. J. Jarvis, General Manager of this road, says it will be built very soon.